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THE

PROCEEDINGS

OF THE

LINNEAN SOCIETY

OF

NEW SOUTH WALES.

(SECOND SERIES.)

VOL. VI.

WITH FORTY-THREE PLATES.

(Plates i.-xii., xii. *bis*, and xiii.-xlii.)

FOR THE YEAR 1891.

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CONTENTS OF VOL. VI.

(SECOND SERIES.)

PART I.

(Issued September 9th, 1891.)

PAGE

Notes on the occurrence of Stilbite in the Eruptive Rocks of Jamberoo, N.S.W. By B. G. Engelhardt. (Plate I.) 5

Notes on a small Collection of Hymenoptera from Narrabri, N.S.W. By W. W. Froggatt 13

Description of a new Species of Tortricidæ. By J. Hartley Durrant 17

On the Anatomy of some Tasmanian Land Snails. By C. Hedley, F.L.S., Corr. Mem. (Plates II.-III.) 19

Stray Notes on Lepidoptera. No. 2. By A. Sidney Olliff 27

Notes on Australian Aboriginal Stone Weapons and Implements. Nos. X.-XV. By R. Etheridge, Junr. (Plates IV.-VIII.)... ... 31

On the Classification of Eucalypts. By the Rev. W. Woolls, Ph.D., F.L.S. 49

The Land Molluscan Fauna of British New Guinea. By C. Hedley, F.L.S., Corr. Mem. (Plates IX.-XII. and XII. *bis*.)... 67

On the Trail of an Extinct Bird. By C. W. De Vis, M.A., Corr. Mem. 117

Note on an Extinct Eagle. By C. W. De Vis., M.A., Corr. Mem. ... 123

Elections and Announcements 1, 9, 45

Donations 1, 9, 45

Notes and Exhibits 8, 43, 125

a 69336

PART II.

(Issued December 22nd, 1891.)

PAGE

On the Occurrence of Barite (Barytes) in the Hawkesbury Sandstone near Sydney. By H. G. SMITH, Technological Museum, Sydney... 131

Notes on Australian Economic Botany. No. II. By J. H. MAIDEN, F.L.S., F.C.S. 133

On the occurrence of a Gum in *Echinocarpus (Sloanea) Australis*, Benth. By J. H. MAIDEN, F.L.S., F.C.S. 140

Onyx and *Dipeltis*: new Nematode Genera, with a Note on *Dorylaimus*. By N. A. COBB 143

In confirmation of the Genus *Owenia* so-called. By C. W. DE VIS, M.A., Corr. Mem. (Plate XIII.) 159

A Contribution to the Geology and Petrography of Bathurst, N.S.W. By Rev. J. MILNE CURRAN, F.G.S. (Plates XIV.-XVIII.) 173

Remarks on Post-Tertiary *Phascolomyidæ*. By C. W. DE VIS, M.A., Corr. Mem. 235

Description of a new Marine Shell. By C. HEDLEY, F.L.S., and C. T. MUSSON, F.L.S. (Plate XIX., figs. 1-3) 247

Note on the Ova of *Helicarion robustus*, Gould. By C. HEDLEY, F.L.S. 248

Angophora Kino. By J. H. MAIDEN, F.L.S., F.C.S. 253

The Incisors of *Sceparnodon*. By C. W. DE VIS, M.A., Corr. Mem. (Plate XXII.) 258

Contributions to a more exact Knowledge of the Geographical Distribution of Australian Batrachia. No. II. By J. J. FLETCHER . 263

Description of a supposed new Cystignathoid Frog. By J. J. FLETCHER 275

Description of a new Cone from Mauritius. By J. BRAZIER, F.L.S. (Plate XIX., fig. 4.) 276

On Queensland and other Australian Lepidoptera, with Descriptions of New Species. By THOMAS P. LUCAS, M.R.C.S.E., L.S.A. ... 277

Elections and Announcements 127, 169

Donations 127, 169, 250

Notes and Exhibits 166, 248, 307

PART III.

(Issued May 23rd, 1892.)

	PAGE
The Silurian Trilobites of New South Wales, with References to those of other parts of Australia. Part i. By R. ETHERIDGE, Junr., Palæontologist to the Australian Museum, and Geological Survey of N.S.W.; and JOHN MITCHELL, Public School, Narellan. (Plate XXV.)	311
On the Synonymy of *Helix (Hadra) gulosa*, Gould. By JOHN BRAZIER, C.M.Z.S., F.L.S.	321
Observations on the *Chloraemidae*, with special Reference to several Australian Forms. By W. A. HASWELL, M.A., D.Sc. Edin., F.L.S., Challis Professor of Biology, University of Sydney. (Plates XXVI.-XXVIII.)	329
Notes on Australian Aboriginal Stone Weapons and Implements. Nos. xvi.-xvii. By R. ETHERIDGE, Junr., Palæontologist to the Australian Museum, and Geological Survey of N.S.W. (Plates XXIX.-XXXVI.)	357
The Examination of Kinos as an Aid in the Diagnosis of Eucalypts. Part iii.—The Turbid Group. By J. H. MAIDEN, F.L.S., F.C.S.	389
Descriptions of two new Species of *Carenum* from West Australia, with Notes on the Synonymy and Distribution of some previously described Species. By T. G. SLOANE	427
Jottings from the Biological Laboratory of Sydney University. By Professor W. A. HASWELL, M.A., D.Sc.—	
15. On a simple Method of substituting strong Alcohol for a watery Solution in the Preparation of Specimens	433
Residue of the Extinct Birds of Queensland as yet Detected. By C. W. DE VIS, M.A., Corr. Mem. (Plates XXIII.-XXIV.)	437
Observations on Plants collected during Mr. J. Bradshaw's Expedition to the Prince Regent's River. By Baron von MUELLER, K.C.M.G., M.D., Ph.D., F.R.S.	457
Notes on Australian Coleoptera, with Descriptions of new Species. Part x. By the Rev. T. BLACKBURN, B.A., Corr. Mem.	479
On a Collection of Land and Freshwater Shells from Queensland. By C. HEDLEY, F.L.S., and C. T. MUSSON, F.L.S.	551

PART III. *(continued).*

PAGE

Descriptions of some new Species of Pulmonate Mollusca from Australia and the Solomon Islands. By J. C. Cox, M.D., F.L.S. (Plates xx. and xxi.) 565

Description of a new *Diplomorpha.* By W. D. Hartman, M.D. *(Communicated by J. C. Cox, M.D., F.L.S.)* (Plate xxi., figs. 1, 3, and 6) 571

Some New South Wales Plants illustrated. No. i. By R. T. Baker, Assistant Curator, Technological Museum, Sydney. (Plate xxxvii.) 572

Elections and Announcements 308, 382, 383

Donations 308, 383

Notes and Exhibits 307, 381, 574

PART IV.

(Issued June 10th, 1892.)

PAGE

Revision of Australian Lepidoptera. By E. Meyrick, B.A., F.L.S. Part v. 581

On two undescribed Exudations from the Leguminosæ. By J. H. Maiden, F.L.S., &c. 679

The Land Molluscan Fauna of British New Guinea. *(Anatomical Supplement, continued from p. 115.)* By C. Hedley, F.L.S. (Plates xxxviii.-xlii.) 685

On a Form of Womerah, or "Throwing-stick," presumed to be undescribed. By R. Etheridge, jun. (Palæontologist to the Australian Museum, and Geological Survey of N. S. Wales) 699

In Memoriam—Sir William Macleay, Kt., F.L.S., M.L.C. 705

Donations 579, 683

Notes and Exhibits 682, 703

President's Address 706

Office-bearers and Council for 1892 723

Title-page, Contents, Index to Vol. vi. (2nd Ser.), List of Plates, a Corrigenda.

[redacted]

LIST OF PLATES.

VOL. VI.

(SECOND SERIES).

Plate I.—Stilbite from the eruptive rocks of Jamberoo, N.S.W.

Plates II.-III.—Tasmanian Land Snails.

Plates IV.-VIII.—Australian Aboriginal Stone Weapons and Implements.

Plates IX.-XII. and XII. *bis*.—British New Guinea Land Mollusca.

Plate XIII.—*Euowenia robusta*, De Vis.

Plates XIV.-XVIII.—Illustrative of the Geology and Petrography of Bathurst. N.S.W.

Plate XIX.—Marine Mollusca: *Eulimella moniliforme*, Hedley and Musson, and *Conus (Chelyconus) worcesteri*, Brazier.

Plates XX.-XXI.—Australian and Solomon Islands Pulmonate Mollusca.

Plate XXII.—Incisors of *Sceparnodon ramsayi*, Owen.

Plates XXIII.-XXIV.—Queensland Extinct Avian Remains.

Plate XXV.—Australian Silurian Trilobites.

Plates XXVI.-XXVIII.—Australian Chlorœmids.

Plates XXIX.-XXXVI.—Australian Aboriginal Implements.

Plate XXXVII.—*Acacia prominens*, A. Cunn.

Plates XXXVIII.-XLII.—Anatomy of New Guinea Land Mollusca.

CORRIGENDA.

Page 51, line 11—for *E. gueorifolia* read *E. ericorifolia*.

Page 53, line 25—for *E. melissodora* read *E. melissiodora*.

Page 123, line 22—for *Haliastur leucogaster* read *Haliaetus*

Page 474, line 11—for STELLOTROPIUM TENUIFOLIUM rea

TENUIFOLIUM.

Page 558, line 6—for P. PEINCULA read PUPA PEDICULA.

Page 563, line 2—for B. PRYAMIDATUS read B. PYRAMID

(See also Errata on p. 698.)

PROCEEDINGS

OF THE

LINNEAN SOCIETY

OF

NEW SOUTH WALES.

WEDNESDAY, 28TH JANUARY, 1891.

Dr. J. C. Cox, Vice-President, in the Chair.

Mr. Walter S. Duncan, Inverell, was elected a member of the Society.

DONATIONS.

Two Pamphlets entitled—"Notes on West Australian Oology, &c.," and "Notes on the Zoology of Houtman's Abrolhos." By A. J. Campbell, F.L.S. *From the Author.*

"Journal of the Marine Biological Association of the United Kingdom." *From the Association.*

"The Victorian Naturalist." Vol. VIII., Nos. 8 and 9 (Dec., 1890, and Jan., 1891). *From the Field Naturalists' Club of Victoria.*

"Proceedings of the Zoological Society of London for 1890." Part 3; "Abstracts" for Nov. 8th, and Dec. 2nd, 1890." *From the Society.*

Asiatic Society of Bengal—"Journal." Vol. LI. (1882), Part i., Nos. 1-4, Part ii., Nos. 1-4; Vol. LII. (1883), Part i. Nos. 1-4, Part ii., Nos. 1-4 (in 2 without title page and Plates i., ix. and x.); Vol. LIII. (1884), Part i., Nos. 1, 2, and Special No. (= Nos. 3 and 4), Part ii., Nos. 1-4; Vol. LIV. (1885), Part i., Nos. 1-4, Part ii Nos. 1-4; Vol. LV. (1886), Part i., Nos. 1-3, Part ii, Nos. 1 Vol. LVII (1888), Part ii., No. 5; Vol. LVIII. (1889), Par Suppl. (= Part 4); Vol. LIX. (1890), Part i., Nos 1 and 2, ii., No. 1 and Suppl. No. 1; "Proceedings" for the years 1886, and 1890, Nos. 1-3. *From the Society.*

"Comptes Rendus des Séances de l'Académie des S Paris." Tome CXI., Nos. 14-20. *From the Academy.*

"Geological and Nat. Hist. Survey of Canada.—Cat Canadian Plants. Part V.—Acrogens." By J. Mac "List of Canadian Hepaticæ." By W. H. Pearson. *Director of the Survey.*

"American Naturalist." Vol. XXIV., No. 28 *From the Editors.*

"Johns Hopkins University Circulars." V (Nov., 1890). *From the University.*

"U. S. Department of Agriculture.—Insect No. 3 (Nov., 1890). *From the Secretary of Ag ton.*

"Proceedings of the United States Nati XIII., Nos. 822-824, 826-828 (1890). *Fr*

"Feuille des Jeunes Naturalistes." *From the Editor.*

"Société Botanique de Lyon.—Bull 3." *From the Society.*

"The Perak Government Gazette." Vol. III., No. 34 (Dec. 12, 1890). *From the Government Secretary.*

"The Journal of Comparative Medicine and Veterinary Archives." Vol. XI., No. 11 (Nov., 1890). *From the Editor.*

"Zoologischer Anzeiger." XIII. Jahrg., Nos. 350 and 351 (Dec., 1890). *From the Editor.*

"Bulletin de la Société Royale de Géographie d' Anvers." Tome XV., Fasc. 1 (1890). *From the Society.*

"Bulletin de la Société Belge de Microscopie. XVII.[me] Année, No. 1 (Oct., 1890). *From the Society.*

"The Spectrum—An Australian Journal of Science." Vol. I., No. i. *From the Editor.*

"New Zealand Journal of Science." Vol. I., new Series, No. 1 (Jan., 1891). *From the Publisher.*

"Reichenbachia—Orchids Illustrated and Described." By F. Sander. Second Series. Vol. I., Parts 1 and 2; "Berliner Entomologische Zeitschrift." LIII. Band, 1 Heft (1890); "Stettiner Entomologische Zeitung." 51 Jahrg., Nos. 4-6 (1890). Also the following Journals, Magazines, &c., for 1890, as published:—"The Athenæum;" "Annals and Magazine of Natural History;" "English Mechanic;" "Entomologist;" "Entomologists' Monthly Magazine;" "The Field;" "Geological Magazine;" "The Ibis;" "Journal of Anatomy and Physiology;" "Journal of Botany;" "Nature;" "Proceedings of the Royal Geographical Society;" "Quarterly Journal of Microscopical Science;" "Science Gossip;" "The Zoologist;" "The Scottish Geographical Magazine." *From the Hon. Sir William Macleay, F.L.S., M.L.C.*

"Records of the Geological Survey of India." Vol. XXIII., Part 4 (1890). *From the Director.*

"Department of Mines—Memoirs of the Geological Survey of N.S.W. Palæontology, No. 7. The Mesozoic and Tertiary Insects of N.S.W." By R. Etheridge, Junr., and A. S. Olliff. *From the Minister for Mines.*

"Reports of Geological Explorations (New Zealand) during 1887-88"; "Twenty-third Annual Report on the Colonial Museum and Laboratory" (New Zealand); "Report on a Journey from Adelaide to Hale River." By H. Y. L. Brown. *From R. Etheridge, junr., Esq.*

"Grundzüge der Botanik" (1877). Von Dr. C. Luerssen; "Methodisches Lehrbuch der allgemeinen Botanik" (1880). Von Dr. W. J. Behrens; "Lehrbuch der Botanik für Mittelschulen" (1876). Von Dr. K. Prantl; "Grundzuge der Zoologie" (1876). Von Dr. C. Claus; "Entwickelungsgeschichte der Wirbelthiere" (1861). Von H. Rathke; "Zur Morphologie der monokotylisch Knollen- und Zwiebelgewachse" (1850). Von T. Irmisch; "A gemeine Betrachtungen über die Triebe der Thiere" (1773). H. S. Reimarus; "Geologie oder Entwickelungsgeschicht Erde und ihrer Bewohner" (1858). 2 Vols. Von Sir C Lyell; "Recherches Helminthologiques en Danemark Islande" (1866). Par H. Krabbe; One bound vo Pamphlets on biological subjects. *From Oscar Katz, Es Ph.D.*

"Bulletin de la Société Impériale des Naturalistes de Année 1890, No. 2. *From the Society.*

"Annales de la Société Royale Malacologique de B XXIV. (1889); Procés-verbeaux des Séances" (Ar August, 1890). *From the Society.*

"Australasian Journal of Pharmacy." Vol. 1891). *From the Editor.*

[redacted]

PAPER READ.

NOTES ON THE OCCURRENCE OF STILBITE IN THE ERUPTIVE ROCKS OF JAMBEROO, N.S.W.

By B. G. Engelhardt.

(Plate I.)

This zeolite is mentioned by Prof. Liversidge, M.A., F.R.S., as having been found in a few New South Wales localities,* but, as far as I am aware, it has not yet been reported from Kiama and its vicinity. While collecting specimens of the different eruptive rocks in the neighbourhood of Jamberoo, I observed a bright red mineral in some pieces of a dense, fine-grained basalt, obtained from the northern flank of "Wallaby Hill," an eminence on the south of the Minnamurra Valley. Shortly after, I found the same mineral in a porphyritic dolerite, not far from the locality just mentioned.

In either the basalt or dolerite, the mineral in question occurs almost invariably in more or less circular crystalline masses, from 5 to 100mm. in diameter; but in one instance it was found to have filled up a small fissure in the surrounding rock, having spread itself as a crust of small crystals over the adjacent surfaces of the matrix. The cleavage planes of the individual crystals in the stellate groups (in which form the mineral occurs most frequently) show the characteristic pearly lustre of stilbite. The crystals are flat prisms whose cleavage is so perfect, parallel to their shorter planes, that it was easy to split off laminæ sufficiently thin and transparent for microscopical observation by transmitted light.

In colour the mineral varies from a yellowish-white to purple-brown, but the most usual tints are flesh-red, scarlet, and brick-red.

* Minerals of N.S.W., 1888, p. 187.

Its hardness, tested at right angles to its cleavage, is above 3, calcite being easily scratched by it. Want of a sufficiently delicate balance prevented me from making an attempt to determine its specific gravity. The crystals are subtranslucent to opaque.

Before the blow-pipe the mineral gave the following reactions: it exfoliated, swelled up into curiously shaped white ramifications, fusing easily to an opaque white enamel. Moistened with cobalt nitrate and strongly ignited, the assay gave a somewhat dull blue mass, indicating presence of alumina. In the closed tube it yielded water readily. The powdered mineral was decomposed by hot hydrochloric acid, leaving after evaporation the silica as a somewhat slimy powder. The filtered solution, after super-saturation with ammonia, gave with oxalic acid a distinct white precipitate of oxalate of lime.

I next examined a thin cleavage section under the microscope. Its appearance by central illumination when magnified 50 diameters is shown in Pl. I., fig. 1. Bright orange bands, more or less rectilinear, and of varying degrees of intensity of colour, traverse the section of the mineral parallel to each other. (The greater or less vividness of the tint, no doubt, depends on the thickness of the section at various points, as well as on the mass of pigment injected.) These bands are crossed at right angles by others having either the same colour or a brownish tint Between these coloured stripes appear colourless or faintly yellow portions, while everywhere, but especially in the deeply coloured regions, groups of black dots are visible, often arranged into lines running parallel to the orange bands mentioned above. Irregularly scattered over the colourless or faintly yellow parts of the slide are small patches of a bright yellow or orange tint, encircling a greater or less number of small black particles. At the point marked A in Pl. I., fig. 1, these crystallites are arranged in lines concentric with the contour of the surrounding colour patch. Prof. Zirkel, in his "Beschaffenheit der Mineralien und Gesteine,"* states that these

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* *Op. cit.*, p. 167.

black spots are the pigment which gives to stilbite its various shades of colour, and that they are microscopic crystals of either göthite, limonite, or perhaps red hematite, the mineral itself being originally colourless.

Pl. I., fig. 2, represents an almost colourless section of stilbite, only a few yellow spots being visible, but the orange bands are almost totally absent, while comparatively few of the black crystallites are present. In a similar specimen, unfortunately lost by an accident in mounting, I observed some beautiful dendrites of a bright sulphur-yellow, and as perfectly developed as the macroscopic dendrites of manganese oxide so often found on the cleavage planes of schists, slates, &c.

The occurrence of these dendritic aggregates tends to prove, to my mind, conclusively, that the pigment of red stilbite entered the mineral by the process of secondary infiltration of a solution of hydrated per-oxide of iron, derived from the hydration of the magnetite in the surrounding basalt. The solution has spread itself between the thin laminæ composing the prisms of stilbite, having found its way through the hair-like cracks (due to shrinkage caused by the drying-up of the fluid in which the zeolite crystallized) which can be seen traversing the section in irregularly curved lines.

Between crossed Nicols the mineral proved to be anisotropic, suffering four extinctions in a complete revolution of the section. It is also very slightly pleochroic, the different tints darkening feebly when the section is rotated above the fixed polariser.

NOTES AND EXHIBITS.

In reference to Mr. Engelhardt's paper Mr. David remarked that the occurrence of stilbite at Kiama was very interesting. He too had noticed the presence of the same mineral with remarkable persistence in the lavas which are interbedded with the productive coal-measures of Raymond Terrace, Maitland, and Greta, which lavas are probably of near about the same age as those of Kiama. Mr. R. L. Jack, F.G.S., the Govt. Geologist of Queensland, ha recorded the occurrence of a similar mineral in the lavas whi there underlie the Bowen River coal-field. This is the first rec however of the occurrence of stilbite at Kiama.

Mr. Brazier exhibited a lamp of native pottery from the Islands, collected by Dr. John Rabe. Also on behalf of M Rossiter, Corr. Member, of Noumea, New Caledonia, two v examples of *Cypræa tigris*, Linné, having the dorsal surface bright yellow colour with very few spots, the margins ha spots very small and of a beautiful cream colour.

Mr. Froggatt exhibited two specimens of a grassho *Gryllidæ)*, taken at Double Bay, which frequents th *Eucalyptus corymbosa* in order to capture the comm *(Apis mellifica)* visiting the blossoms.

Also, a few specimens of Hymenoptera receive T. Blackburn, B.A., who captured them on the of from 5,000 to 6,100 feet, during his trip t Alps, Victoria, last November.

Mr. Musson exhibited on behalf of Mr. Mose example of the freckled duck, *Stictonetta næv* at Narran, near Angledool, not far from th early in December last.

The Rev. R. Collie showed an interestir from Wollongong, and a fine specimen of Island.

WEDNESDAY, 25TH FEBRUARY, 1891.

The Hon. James Norton, LL.D., M.L.C., in the Chair.

Mr. C. J. K. Uhr was present as a visitor.

DONATIONS.

Pamphlet entitled "The Lejeuneæ of Lindenberg's Herbarium." By W. H. Pearson. *From the Author.*

"Journal of the Royal Microscopical Society, 1890." Part 6 (Dec.). *From the Society.*

"Bulletin de la Société Belge de Microscopie," XVII^me. Année, No. 2 (1890). *From the Society.*

"The Perak Government Gazette." Vol. iii., No. 35 (Dec., 1890). *From the Government Secretary.*

"Report upon the State Forests of Victoria." By G. Perrin, F.L.S. *From the Author.*

"Hints for the Preservation of Specimens of Natural History" (4th edition). *From the Trustees of the Australian Museum.*

"Journal and Proceedings of the Royal Society of N.S.W." Vol. XXIV. Part 1 (1890). *From the Society.*

"Proceedings of the American Academy of Arts and Sciences." Vol. XXIV. (1888-89). *From the Academy.*

"The Journal of the Cincinnati Society of Natural History." Vol. xiii., No. 2 (1890). *From the Society.*

"Bulletin of the Museum of Comparative Zoology at Harvard College, U.S.A." Vols. I., II. (wanting No. 1), III. (wanting Nos. 1, 2, 5, title-page and index), IV., V. (wanting Nos. 2-5), VI., VII. (No. 1 and index), VIII., IX., X., No. 1 (1863-82), and XX., Nos. 3 and 4 (1890); "Annual Report, 1889-90." *From the Curator.*

"Johns Hopkins University Circulars." Vol. X., No. 84 (Dec., 1890). *From the University.*

"The American Naturalist." Vol. XXIV., No. 287 (Nov. 1890). *From the Editors.*

Department of Agriculture, U.S.A.—"Insect Life." Vol. No. 4 (1890). *From the Secretary of Agriculture.*

"The Canadian Record of Science." Vol. IV., No. 4 (*From the Montreal Nat. Hist. Society.*

"The Journal of Comp. Medicine, and Veterinary A Vol. XI., No. 12 (1890). *From the Editor.*

U.S. National Museum.—"Proceedings." Vol. X 821 and 825; "Report," 1887-88 (Ten Parts, pp. 3- 107-111, 225-386, 387-491, 493-529, 531-587, 589-59 677-702). *From the Museum.*

"L'Académie Royale de Copenhague—Bulletir No. 2 (Mars-Mai). *From the Society.*

"Zoologischer Anzeiger." xiii. Jahrg. No. xiv. Jahrg. No. 353 (Jan., 1891). *From the*

"Comptes Rendus des Séances de l'Académ Paris." Tome cxi., Nos. 21-23 (Nov. and D *the Academy.*

Three Government Reports—[1] "Food-Fishes of Queensland" (1889); [2] "Pearl and Pearl-shell Fisheries of Queensland" (1890); [3] "Bêche-de-Mer and Pearl-shell Fisheries of N. Queensland;" also two Pamphlets, "Presidential Address to the Queensland Royal Society" (Nov., 1890); and "Oysters and Oyster-culture in Australasia." By W. Saville-Kent, F.L.S., F.Z.S., &c. *From the Author.*

"Victorian Naturalist." Vol. XII., No. 10 (Feb., 1891). *From the Field Naturalists' Club of Victoria.*

"Feuille des Jeunes Naturalistes—Catalogue de la Bibliothèque." Fasc. No. 10. *From the Editor.*

"The Darwinian Theory of the Origin of Species." By F. P. Pascoe, F.L.S. *From the Author.*

"Transactions of the Entomological Society of London, 1890." Part iv. (Dec., 1890). *From the Society.*

"Leitfaden für den Unterricht in der Zoologie." Von Dr. Otto Vogel; "Vorwort zu dem Leitfaden;" "Zoologische Zeichentafeln;" "Leitfaden, &c., in der Botanik;" "Die Cryptogamen Deutschlands." Von Dr. O. Wünsche (1875); "Pflanzen-Tabellen." Von Dr. A. B. Frank; "Synopsis der Pflanzenkunde" (1847). Von Prof. J. Leunis; "Die Lebenden Schnecken und Muscheln der Umgegend Berlins." Von J. P. E. Stein. *From Dr. Katz.*

"Agricultural Gazette of N.S.W." Vol. II. Part 1 (Jan., 1890). *From the Director of Agriculture.*

"Journal of Conchology." Vol. vi., No. 8 (Oct., 1890). *From the Conchological Society of Great Britain.*

"The Minerals of New South Wales, etc." (1888). By A. Liversidge, M.A., F.R.S.; "Records of the Geological Survey of N.S.W." Vol. II. Part ii. (1890). *From the Department of Mines.*

"Bulletin de la Société Zoologique de France." Tome XV., Nos. 8 and 9 (1890). *From the Society.*

"Bollettino dei Musei di Zoologia ed Anatomia Comparata della R. Università di Torino." Vol. V., Nos. 74-93 (1890). *From the Museum.*

"Department of Agriculture, Brisbane—Bulletin." Nos. 1-6 (1890). *From the Under-Secretary for Agriculture.*

"List of named Insects in the South Australian Museum Adelaide." Third Series. *From J. G. O. Tepper, Esq., F.L.S.*

NOTES ON A SMALL COLLECTION OF HYMENOPTERA FROM NARRABRI, N.S.W.

By Walter W. Froggatt.

I beg to offer the following brief notes, bearing chiefly on the subject of geographical range, on a small but very interesting collection of bees and wasps obtained in the neighbourhood of Narrabri, N.S.W., by Mr. C. T. Musson, F.L.S., and forming part of the general collection exhibited by him at the meeting of this Society in December last. As far as it goes it is a typical collection of Australian hymenoptera ; no species of *Formicidæ* or *Mutillidæ* are represented in it, and Mr. Musson, to whom I am indebted for the specimens, tells me that he only took such wasps and bees as thrust themselves under his notice while collecting land molluscs. As little has yet been done in systematically collecting hymenoptera in this part of New South Wales, I have no doubt, judging from the specimens now before me, that it would prove a rich field to anyone devoting his time to this group.

Altogether, twenty-four species are contained in Mr. Musson's collection ; but several of them are not in sufficiently good condition for determination.

1. Gen. et sp. incert. (Fam. *Ichneumonidæ*, subfam. *Cryptinæ*).
   This species also occurs at Adelaide, S.A., in Victoria, and at Sydney, where it is plentiful, and is parasitic on the larva of a common garden moth.

2. Gasteruption sp. (Fam. *Evannidæ*).
   A species which also occurs about Sydney.

3. Chrysis sp. (Fam. *Chrysididæ*).
   A species which has a wide range from Sydney northwards. Several species are parasitic in the clay nests of *Alastor*, and other genera of *Eumenidæ*.

4. SCOLIA CORONATA, Smith.

A large black wasp, with beautiful deep blue wings; one of our commonest Sydney insects, but with an extensive range.

5. POMPILIUS AURIFRONS, Smith.

Also an insect with a very wide range, having been recorded from all parts of Australia.

6. PELOPŒUS LÆTUS, Smith.

Two specimens of this handsome slender-bodied wasp; unlike the members of most of the genera of the family *Sphegididæ*, it constructs clay cells, which it provisions with small spiders. It has a considerable range along the eastern coast, and is a common insect in the dry western or central lands.

7. AMMOPHILA SUSPICIOSA, Smith.

This species has a range from South Australia to Queenslan and is another of the common wasps in the western coun where, in company with the last species, it may be t hovering over the flowers along the banks of creek lakes.

8. PISON SPINOLÆ, Shuckard; and
9. P. MARGINATUS, Smith. } (Fam. *Larridæ.*)

Members of this genus construct very thin clay nest oval or elongate form, which they store with lepi larvæ; the young wasp larvæ, when full grown, fo cocoons in which to undergo their metamorphosis. above species are recorded from Adelaide and Sy

10. ODYNERUS CONCOLOR, Saussure.
11. O. BICOLOR, Saussure.

Both species range from North Queensland t Wales.

12. DISCŒLIUS sp.?

I have this species also from Adelaide and Syd

13. POLISTES HUMILIS.

This large red-coloured paper wasp takes *P. variabilis*, Sauss., in the western p

Wales, and is much dreaded by bushmen on account of its severe sting. It is most likely this species which stung Major Mitchell ("Three Expeditions," &c., Vol. I., p. 104), and not *Abispa australiana*, Mitch., as generally stated.

Several of the most interesting specimens belong to the family *Thynnidæ;* and though so many species of this large family are restricted in their range, no part of Australia is without some representative of this fine group. Australia is the home of *Thynnus*, the only other parts of the world in which the species are found being several of the islands in the Pacific, and the western coast line of South America. According to Cresson's Catalogue the genus does not extend into North America.

14. THYNNUS sp. (3 ♀s).

The females being wingless, often quite unlike in markings, and not one-third the size of, the males, it is almost an impossibility to determine a species from female specimens alone.

15. THYNNUS PULCHRALIS, Smith.

This beautiful wasp was described from South Australia, and is figured in Brenchley's "Cruise of the Curaçoa" (1873). It has also been recorded from Rockhampton and Port Denison, Queensland, and the northern parts of New South Wales.

16. THYNNUS BRENCHLEYI, Smith.

This distinctly marked insect was named by Smith after Brenchley, who captured it at Champion Bay, W.A., and presented the specimen to the British Museum. This species is not represented in any of the collections in Australia, and Mr. Musson's capture of it on the opposite side of the continent, almost in the same latitude (Champion Bay being about 100 miles north of Narrabri), is a very remarkable discovery.

While referring to this group I should like to call attention to another species described and figured in Brenchley's work, under the name *T. conspicuus*, Smith, from the N.W. coast of Australia. A number of specimens of this species are in the Macleay Museum, which were taken by me feeding on the flowers of

Melaleuca leucadendron growing on the banks of the Fitzroy River, near Derby, N. W. Australia. Previous to this, Smith (Trans. Ent. Soc. London, 1868, p. 233) had described a very different species from South Australia under the same specific name. Both specimens are in the British Museum, so that it is hard to understand why the error has not been rectified before.

I should propose that the northern species, which evidently has no right to the specific name *conspicuus*, should be re-name *Smithii*.

17. XYLOCOPA MUSCARIA, Smith.

Four specimens (♀) of the common carpenter-bee, which c structs nests in the flower stalks of the grass-trees (*Xan rhœa*); found all over New South Wales.

18. XYLOCOPA ÆSTUANS, Latr.

Four specimens of this larger species, which ranges int Queensland.

19. CROCISA NITIDULA, Fabr.

This handsome spotted bee has a wide range, f Australia to North Queensland.

20. ANTHOPORA PULCHRA.

Three specimens of this fine blue-banded bee, wh over the greater part of Australia.

21-23. MEGACHILE spp.

Five specimens of leaf-cutting bees, referable t all of which are also to be found about Sydr

DESCRIPTION OF A NEW SPECIES OF TORTRICIDÆ.

By J. Hartley Durrant.

(Communicated by A. Sidney Olliff.)

TORTRICIDÆ.

GRAPHOLITHINÆ.

PALÆOBIA, Meyr.

Palæobia longestriata, sp.nov.

Antennæ pale cinereous.

Palpi ochreous-brown, paler above.

Head and thorax ochreous-brown.

Forewings elongate, costa slightly arched at base, apical margin sinuate, apex hardly produced: ochreous-brown, above the fold a longitudinal white line extending from the base, becoming abruptly attenuated before attaining a somewhat triangular white spot, situated above the fold near the anal angle. This spot is convex towards the base of the wing, and very slightly concave externally; above and before the triangular spot is a small round white spot; between this spot and the longitudinal line the ground-colour is slightly darker, the basal two-thirds of the wing below the costa are slightly clouded with whitish, the veins themselves being indicated by the brownish ground-colour; two distinct brown spots, separated by the paler colour, are situated on the apical third of the costa, the outer of which is continued across the wing as an indistinct fascia, becoming most noticeable on the outer side of the triangular spot; this darker colouring is margined by a very indistinct paler fascia; cilia slightly paler than the ground-colour with a darker line running through them near their base.

Hindwings cinereous, slightly darker externally; cilia cinereous, faintly tinged with ochreous and having a darker line running through them near their base.

Abdomen greyish-fuscous; anal tuft paler.

Legs pale greyish-fuscous.

Exp. al., 15-17 mm.

Hab: Tumut (C. W. Peel), Mt. Kosciusko, N.S. Wales, 6000ft., March, 1889 (R. Helms, Aust. Mus.).

Type, ♂♀, Mus. Walsingham.

This species agrees in neuration and structure with the typical forms, but can hardly be said to have the apex of the forewing produced. It is a very distinct species.

[redacted]

ON THE ANATOMY OF SOME TASMANIAN SNAILS.

By C. Hedley, F.L.S., Corr. Mem.

(Plates II. and III.)

The material for this paper was chiefly collected by myself during a short holiday excursion to the Island of Tasmania. To Mr. W. F. Petterd, of Launceston, the well-known conchologist, and to Mr. W. R. Dyer, of Scottsdale, I am under great obligations; without the kind assistance of these gentlemen my scientific booty would have been but small.

As far as the shells are concerned, the molluscan fauna of Tasmania has been closely studied, but information regarding structural details of the animals is much needed. For until we have acquired this knowledge, no classification worthy of the name can be constructed. Full particulars of the shells whose soft parts I am about to describe will be found in the Monographs of Dr. Cox, Messrs. Legrand and Petterd, and further notices in the writings of Reeve, Semper, Quoy and Gaimard, Tenison-Woods, Tryon, Pilsbry, &c. It will therefore be unnecessary for me to add bibliographical references in dealing with these well-known species.

Bulimus dufresni, Leach.

This handsome shell has attracted the notice of every scientific visitor to the island. The figure of the animal in the "Voyage of the Astrolabe," Vol. II, pl. x., fig. 1, is unsatisfactory, showing as it does a well-marked pedal groove where none exists. I have therefore re-figured it in the accompanying plate. From a specimen of the small variety common round Hobart I drew up

the following description :- Animal 35 mm. in total length and, measured a little posterior to the tentacles, 6 mm. in breadth, and the same in height; colour slate, sometimes with a yellowish tinge on the body, darkening into black on the tentacles, greyish-yellow on the sole of the foot and on the mantle-collar; the muzzle and anterior dorsal area (in short, that space enclosed by the two conspicuous furrows which run back from the lips to the mantle, which I will call the *facial area*) are ornamented by long narrow tubercles, arranged in about a dozen longitudinal rows, the sides and tail are divided into irregular polygonal spaces, which are partially subdivided and finely granulated; the tail tapers slightly, is rounded posteriorly, and never keeled; the tentacles are 10 mm. long, tapering gradually, finely granulated, the bases 3 mm. apart, the terminal bulb is asymmetrical, bein only developed on the under side; the genital orifice appears j beneath the groove bounding the facial area, 5 mm behind right oculiferous tentacle. Habits bold and active; the tail first portion to emerge from the mantle and the last to dis within it; when the animal is in motion the axis of the oblique to that of the body, the initial whorl being carried right side of the tail, which projects 2 or 3 mm. beyond penultimate whorl resting on a wide, smooth, saddle-like haunts the under side of logs, stones, fallen tree-fern ranges over the whole island. Another animal, from rooma district, measured, total length 46 mm., hei length of tentacles 15 mm. The egg has been d figured by Tenison-Woods (P.L.S.N.S.W., Vol. III., fig 1a.). Specimens of the egg of this species, wh from Mr. Petterd, do not quite accord with t quoted; they are regularly oval, not so rounde pure white, shining, minutely granular, the gra through a lens recalling those on an emu's 11 mm.; minor axis, 8 mm. Mr. Dyer tells

deposited in the ground under a log during October and November. The radula and genitalia have been figured by Semper, who incorrectly locates the species in the Sandwich Islands (Reis. im Philip. Vol. III., p. 123, pl. xii., figs. 23, 24, 25, and pl. xvi., fig. 7). The jaw I find to be boomerang-shaped, smooth, arcuate, ends rounded, with no median projection.

BULIMUS TASMANICUS, Pfeiffer.

This species is arboreal in its habits, and confined to a narrow belt of coast country. I was unable to visit its haunts and view the creature alive. Mr. Petterd kindly presented me with some alcohol specimens, from Maria Island, for dissection. He informs me that the animal is greenish-grey in colour, with flat, thin, pointed tail. This species, as might be inferred from the resemblance of the shells, closely approaches *B. mastersi*, Cox, (P.R.S.Q., Vol. VI., p. 250, pl. xiv.) in its dentition. The jaw is thin, membranous, semitransparent, light horn-colour, crossed obliquely on each side by about sixteen delicate folded ribs denticulating both margins; these ribs run obliquely towards the median line of the jaw, and, meeting in the centre, form a median triangular space. The radula is composed of 130 rows of 84-5-1-5-84; of these the rachidian presents a single, ovate, lanceolate cusp, whose extremity reaches the margin of the basal plate; this is flanked by five laterals having the distal posterior angle of the basal plate briefly alate and a small cusp developed upon the outer base of the main cusp, whose stout ovate blade just projects over the base of attachment; seven rows from the centre the marginal type appears, the main cusp becoming bicuspidate; on approaching the edge of the ribbon the teeth grow smaller, and assume that slender, sinuous aspect so characteristic of extreme marginals. The distinguishing features of the genitalia are:—penis-sac long and slender, produced into an extremely long flagellum, which is coiled up at the tip, and apparently without a

retractor muscle; prostate and vagina spirally twisted, the former connected by a short but much convoluted hermaphrodite duct with the ovotestis, a compact bilobed body.

Anoglypta launcestonensis, Reeve.

This species is confined to a mountainous district in the N.E. of the island. I collected it among the fern-tree gullies on Mr. Dyer's estate, where it was plentiful. The animal was not very different in form from *B. dufresni*, and measured (total length) 47 mm.; tentacles 10 mm.; colour dark chestnut shaded to chocolate on the back, tentacles shaded to black on the tips. Habits very shy and timid, crawling very slowly; it frequents damp places under logs and decaying stems of tree-ferns. The fire and axe o civilisation threaten to diminish the already narrow range of t splendid and interesting species; but its haunts are so rugged remote that I do not fear its extinction. Mr. Dyer says th egg resembling, though different from, that of *B. dufresni* is l this mollusc at similar seasons and in similar localities. Th is rather straight and broad, irregularly slightly dentate cutting margin, smooth on the convex margin, closely ar transversely striate. The teeth are arranged in 160 40-6-1-6-40; the rachidian cusp is single, straight, slen than the laterals, the cutting point reaching four-f length of the widely expanded basal plate; the later single stout cusp with a rounded cutting point ove posterior margin of the basal plate, whose distal m from these the marginals differ in the longer more the extreme marginals having their cusps low notched. The genitalia are characterised by twisted penis-sac, retractor muscle inserted r spermatheca on a long slender duct.

Rhytida lampra, Pfeiffer.

This carnivorous mollusc is generally distributed throughout Tasmania. Mr. Petterd relates its cannibal propensities as similar to those of its Queensland relative (P.R.S.Q., Vol. v., p. 152). The specimen I examined measured, when expanded, 40 mm. from head to tail; but I am informed that the species in other localities attains larger dimensions. Colour, orange-brown on the edge of the foot, passing through chestnut-brown to black upon the head and tentacles, mantle-collar orange-brown. Down the centre of the back runs a small groove from the shell to between the tentacles, and on either side of this the facial area is ornamented by three longitudinal rows of small round tubercles; tail and sides divided into irregular polygonal spaces which are partially sub-divided and finely granulated. The tail is extremely short, hardly passing the shell, while the anterior portion of the body, as in other *Agnatha*, is capable of a leech-like extension, a provision for enabling the creature to stretch itself into the remoter whorls of a shell whose inhabitant it may be engaged in devouring. Habits bold and active; crawls more rapidly than the *Helicidæ* usually do. The radula is constructed of 75 rows of 40-0-40, is strap-shaped, measuring 15 mm. in length and 4 in breadth, each half-row curving from the margin and meeting its fellow at an acute angle in the centre of the ribbon; the rachidian (as is usual in the genus) has been lost, the two innermost laterals are usually rudimentary, but the third attains its full development, having a basal plate the shape of the sole of a man's foot and a straight slender cusp in the same plane, the whole tooth resembling a clasp knife with the blade open; the teeth continue of the same size to the margin, the pattern differing slightly by the basal plate of the remotest becoming triangular. In the genitalia the penis-sac is slender; a sessile globose spermatheca is inserted upon a short pyriform vagina.

Helicarion verreauxi, Pfeiffer.

This is the southernmost member of its genus, the "enfant perdu" of its race. The other species that have been associated with it, *fumosa*, Tenison-Woods, and *milligani*, Pfeiffer, may be referred to *Paryphanta* until their position be authoritatively decided by scalpel and microscope. Like *B. dufresni* and *R. lampra*, this species ranges over the entire island, hiding in dry weather under logs and stones. The animal measures 37 mm. in total length, resembles in form the continental species, *H. robustus*, Gould, and *H. hyalinus*, Pfr., but differs in colour, the entire body being coal black with the exception of the tail, whose extremity is lemon-yellow. The jaw is arcuate, with central projection, smooth, ends rounded. The radula consists of 130 rows of 70-17-1-17-70; the rachidian is broadly reflected and overlaps the basal plate laterally for more than half its length then is divided into a slender lanceolate median cusp exceeding

opportunity of comparing Tasmanian specimens with those collected by Mr. Helms on Mt. Kosciusko, also with some taken by Mr. Musson at Ballarat, and I find no differences of specific importance between them. In Tasmania I gathered the species under the guidance of the gentleman whose name it bears, from the original locality, Cataract Hill, near Launceston. I also found it at Dennison Gorge and on Mr. Dyer's estate, Scottsdale. In the first locality the animals lived under logs, upon a dry, scantily-timbered hillside; in the two latter places they inhabited damp fern-tree gullies. As the consequence, probably, of more favourable surroundings, those from the moist situations were larger in size and lighter in colour than the type variety. Mr. Petterd pointed out that its habits were gregarious. A dozen likely pieces of fallen timber might be searched without result, yet the next might conceal a score of these slugs. The larger form was pale greenish-yellow spotted with black; the black spots on the shield are most irregular in size and distribution. The figure I published from a spirit specimen gives no idea of the animal in life, therefore I append a second sketch taken from a living individual on the spot.

EXPLANATION OF PLATES.

Plate II.

R., Rachidian tooth; o.t., ovotestis; h.d., hermaphrodite duct; ov., oviduct; c.o., common orifice; sp., spermatheca; p., penis-sac; r.m.p., retractor muscle of penis.

Fig. 1. Jaw of *Bulimus dufresni*. Magnified.

Fig. 2. Jaw of *Bulimus tasmanicus*. Magnified.

Fig. 3. Central portion of radula of ditto. Magnified.

Fig. 4. Genital system of ditto.

Fig. 5. Jaw of *Anoglypta launcestonensis*. Magnified.

PLATE II. (*continued*).

Fig. 6. Central portion of radula of ditto. Magnified.
Fig. 7. Genital system of ditto.
Fig. 8. Radula of *Rhytida lampra*. Magnified.
Fig. 9. Genital system of ditto.
Fig. 10. Jaw of *Helicarion verreauxi*. Magnified.
Fig. 11. Central portion of radula of ditto. Magnified.
Fig. 12. Genital system of ditto.

PLATE III.

Fig. 1. Animal of *B. dufresni*.
Fig. 2. Animal of *A. launcestonensis*.
Fig. 3. Animal of *R. lampra*.
Fig. 4. Animal of *H. verreauxi*.
Fig. 5. Animal of *C. petterdi*.

STRAY NOTES ON LEPIDOPTERA.

BY A. SIDNEY OLLIFF,
GOVERNMENT ENTOMOLOGIST, NEW SOUTH WALES.

No. 2.

A short time ago, Mr. Lionel de Nicéville, the author of that admirable handbook "The Butterflies of India, Burmah, and Ceylon," in offering some friendly criticism of my small pamphlet on Australian Butterflies,* published by the Natural History Association (now the the Field Naturalists' Society) of New South Wales, and originally written for a weekly newspaper, suggested to me that the butterfly which, for many years past, has been known in our local collections as *Libythea myrrha*, Godart, was in reality quite distinct from that species. Mr. de Nicéville, I believe, arrived at this conclusion from a comparison of the rough but characteristic figure of the Australian insect, contained in the pamphlet in question, with typical specimens of *L. myrrha*; and I must confess that the suggestion did not cause me much surprise, as I had noticed some months previously, when examining a series of *Libytheæ* from New Guinea, that certain specimens from Port Moresby, although agreeing in every particular with the Australian species, exhibited certain marked differences from the true *L. myrrha*. The genus *Libythea* appears to have been first recorded as belonging to the Australian fauna by Sir William Macleay, who called attention to the presence of a species of the genus (referring to the insect as *Libythea myrrha*) in a small collection of Cape York lepidoptera exhibited at a meeting of the Entomological Society of New South Wales in September,

* "Australian Butterflies: a Brief Account of the Native Families, &c." Sydney, 1889.

1866.* Mr. G. Masters† included the species in his Catalogue of Butterflies, on the authority of specimens obtained at Somerset by Mr. J. A. Thorpe, the taxidermist of the Australian Museum, during a collecting trip which he made to Cape York in the year 1867-68, and others subsequently collected in the same locality by Mr. Damel. The remains of one of the former specimens is in my possession owing to the kindness of Mr. Masters, and I am in a position to definitely state that the insect which has passed for many years in Australia as *Libythea myrrha* is quite distinct from that species, and is identical with the insect here described under the name *Libythea Nicevillei*.

It is hardly a matter of surprise that, once made, the mistake as to the identity of our butterfly should hitherto have escaped detection, as the species is apparently very rare, only one or two specimens existing in collections. As some doubts have bee raised as to the claims of the genus *Libythea* to be regarded a indigenous in Australia, it may be well to state that there can b no question as to the authenticity of the specimens obtained

and extending towards the hind margin; the latter spot divided by vein 3 at about its anterior fourth. Hindwing inclining to dull ochreous-yellow at the base, hind margin darker, with a broad oblique ochreous-yellow discal band or fascia, which extends posteriorly from vein 7; this band is of uniform width throughout, clearly defined in front, and gradually effaced behind. Underside:—Much paler in colour than above. Forewing beyond the anterior markings (which correspond with those of the upper side) and on the inner margin silvery-grey, the apical portion mottled with small irregular transverse brown lines; the discoidal cell occupied by a rather bright ochreous-yellow patch, which is somewhat suffused on the costal margin. Hindwing silvery-grey, indistinctly irrorated with purplish, and closely striated with brown; with indications of two indistinct lighter oblique bands extending from the costal and hind margins respectively to the inner margin near the base. Cilia ochreous-brown. Expanse 53-55 mm.

Somerset, Cape York, N. Australia; and Port Moresby, British New Guinea.

As stated before, this species of *Libythea* has been confused with a species (*L. myrrha*, Godart), with which it has little in common, ever since the first specimens from Cape York were recorded; but it will be evident upon even the most cursory comparison of the Australian form and *L. myrrha* that the species are abundantly distinct. In the Australian insect the forewings are comparatively broader, with the hind margins less distinctly angulated below the apex, and the disk ornamented with whitish markings. The characteristic transverse streak in the cell of the forewing of *L. myrrha* is replaced in our species by a single rounded spot, in which respect it resembles the Indian *L. rohini*, Marshall,* described from the Khasi Hills. The latter species, indeed, would appear to be its nearest ally, although sufficiently distinguished by having the markings on the hindwing white like those of the forewing, and by the presence of additional spots near the costa of the former.

* Journ. A. S. Bengal, XLIX., p. 248 (1880), and de Nicéville, "Butterflies of India, &c.," II., p. 303, pl. 24, fig. 114, ♀ (1886.

HESPERIIDÆ.

Euschemon Rafflesiæ, Macleay.

E. albo-ornatus, var. nov.

A striking modification of this remarkable Hesperid was obtained at Dunoon, Richmond River, during the month of April by Mr. R. Helms, in which the fore and hindwings are intense blue-black in colour, and the markings silvery-white instead of bright yellow as in the typical form. Except for the presence of a larger number of blue scales near the hind margin of the forewing (in the shape of a gradually narrowing band) and on the underside, the type and the modification here recorded agree marking for marking. An examination of some thirty specimens of *Euschemon Rafflesi* from various localities, has revealed little or no tendency to v in colour or marking, a fact which increases the interest attac to the Dunoon specimen.

NOTES ON AUSTRALIAN ABORIGINAL STONE WEAPONS AND IMPLEMENTS.

By R. Etheridge, Jun., &c.

(Palæontologist to the Australian Museum, and Geological Survey of New South Wales.)

(Plates iv.-viii.)

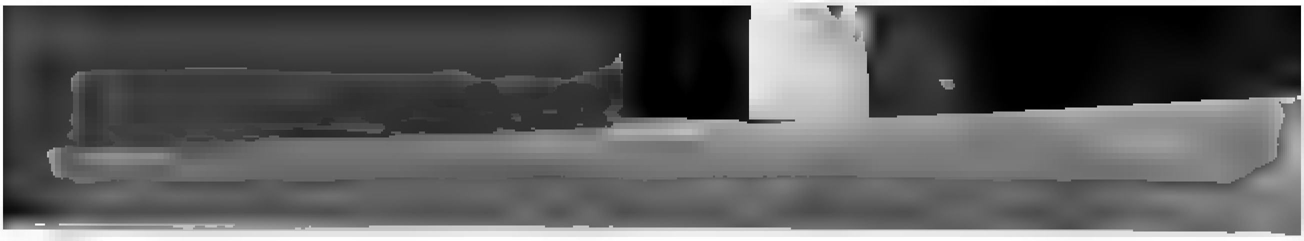
I am able to continue* investigations in this interesting subject through the kindness of several collectors, notably Sir W. Macleay, Dr. J. C. Cox, and Mr. C. W. de Vis, M.A., Curator of the Queensland Museum. To the first I am indebted for the loan of nine stone weapons from "various parts of N. S. Wales," which were exhibited at this Society's Meeting on October 31st, 1883, by Mr. J. G. Griffin, C.E.†; to the second for a series of N. S. Wales tomahawks in different stages of preparation; and to Mr. De Vis for a valuable selection of implements from the Queensland Museum, Brisbane. There will also be found descriptions of the remainder of Mr. W. W. Froggatt's specimens from North-west Australia; some from the Mining and Geological Museum, and a few others from different sources, which will be suitably acknowledged later on. I am indebted to my colleague Mr. T W. Edgeworth David for assistance in determining the mineralogical composition of the rocks used for the weapons, but as microscopic sections could not be made, the determinations are tentative only.

x.—*Knives.*

(Pl. v., fig. 1; Pl. vi., fig. 1; Pl. vii., fig. 1.)

Mr. De Vis has forwarded to me five knives, three of the general type of those I lately described as used in the Mika operation,‡ but differing in an important particular; one of a

* Proc. Linn. Soc. N. S. Wales, 1890, v. (2), Pt. 2, pp. 251, 289, and 367.
† *Ibid.* 1884, viii., p. 442.
‡ *Loc. cit.* 1890, pp. 251, 289.



flesh-coloured quartzite resembling therein some spear-heads to be noticed later on; and another made of glass (Pl. vi., fig. 1). Four of the knives are mounted, and the fifth has been, as evinced by the still adherent gum at the butt. Two of the mounted, and the unmounted knife from "Northern Queensland," are flaked from an impure, streaky, flint-like quartz, but which does not produce so fine and cutting an edge as those formerly described. They are, with one exception, of a rather different type to the latter. It will be remembered that one of those in the Australian Museum was described as more scalpriform than the others, thicker along the back than at the cutting edge, the surface gradually sloping off from the former to the latter, without any angularity. The three knives in question are of this character, altogether stronger and thicker than the Mulligan River Mika-knife. Evans figures† such a knife in the Christy Collection from Queensland, with a "thick somewhat rounded back, not unlike that of an ordinary knife-blade, the butt being covered with fur and wound round with string."

supposing the knife to be so held. The length of the knives, complete, is respectively eight inches, and seven and a half. The surface of the flints is smooth and shining. When describing the Mika-knives a short time ago, I surmised that they were also used for other purposes, and I have since been informed that such knives are employed in fighting, practically in a kind of duello.

The glass knife (Pl. VI., fig. 1), also from "Northern Queensland," is exceedingly interesting, consisting of a small piece of bottle-glass chipped to an oval form, and mounted with black gum to a small wooden handle, which Mr. F. Turner, of the Department of Agriculture, tells me is probably made of the *Acacia sentis*, a very porous wood. The latter is to some extent split, and conveys the idea that the glass is inserted between the halves, which are also partially wound round with fine string of native manufacture. The entire weapon is six inches in length, but the glass blade extends beyond the gum mounting for one inch only. Several similar knives are figured* by Mr. T. Wilson from Southern Utah and other localities, hafted with wood, the attachment being made with bitumen. One is flint, and the others are made of jasper. Another knife of obsidian has the base wrapped in otter skin. The general appearance of these knives closely resembles those now described, particularly the glass knife.†

The quartzite knife is granular and deep flesh-coloured (Pl. V., fig. 1). It is very interesting as being intermediate in form and character between the Mika-knives,‡ formerly described by me, and a spear-head from Torres Straits, in the Australian Museum, to which my attention was called by my colleague Mr. Brazier. That it is a knife, however, appears tolerably certain from the form of the

* A Study of Prehistoric Anthropology.—Handbook for Beginners. *U.S. Nat. Mus. Report*, 1887-88, p. 639, f. 14, p. 641, f. 75-78.

† Glass has probably been used by the Aborigines for a long time. The York's Peninsula Tribe made their knives of shells and afterward of glass, "for they related that they used occasionally to find bottles on the beach many years before the whites came to reside in South Australia." *Curr's Australian Race*, 1886, II., p. 143.

‡ Proc. Linn. Soc. N. S. Wales, 1890, v. (2), Pt. 2, Pl. 9 and Pl. 11, figs. 8 and 9.

gum handle, which resembles that of the Mulligan River knife* ; whilst the blade is more akin to one of those from "Northern Queensland," in the Australian Museum,† angular in the middle line of one face, flat on the other. The specimen is five and a half inches long, but the apex is a little broken. The cutting edges, although sharp, have not that degree of fineness visible in the Mulligan River knife, which may be described as razor-edged. The edges in the present case are uneven and a little notched, and would inflict a jagged and awkward wound. It is generally comparable to the knife figured by Smyth, used by the natives of Booloo and Cooper's Creek,‡ except that ours does not possess a handle. It is from the Gregory River.

xi.—*Spear-heads from Kimberley.*

(Pl. v., fig. 2 ; Pl. vi., fig. 2 ; Pl. vii., figs. 2 and 3 ; Pl. viii., figs. 1-3.)

Mr. W. W. Froggatt has lent me twelve spear-heads, brought by himself from the Lennard River. They are similar to those lately described by me from the Ord River,‖ now in the Mining and

chocolate-brown clay shale, the green quartzite, those of opaque white jasperoid quartz, and the rock crystal heads are plain edged and without serrations, and so also are three of the milky quartz, but two of the latter and that formed of bottle glass are beautifully and finely serrated. The whole of the faces are facetted by percussion, even in the milky quartz and rock crystal spear-heads, although the facets on the former of these are less apparent than on the others. When we take into consideration the refractory conchoidal fracture of quartz and glass, the chipping of these spear-heads is a remarkable feat, more especially that of the milky quartz heads with their serrations. This teething is not pointed, or "dog-toothed," but each serration is in most instances square, or at right angles, and corresponds exactly to the figure given by Rear-Admiral King, and referred to in my previous account.

The following table gives the measurements of the eleven spear-heads obtained by Mr. Froggatt, with their forms and mineralogical composition.

No.	Form.	Length.	Breadth.	Thickness.	Rock, etc.
1.	Elongately lanceolate, angled on one face.	3¾ in.	1⅛ in.	¼ in.	Bottle glass; edges serrated.
2.	Ditto.	3⅝	1⅛	⅜	White opaque milky quartz; edges serrated.
3.	Ditto.	3⅛	1¼	¼	White opaque milky quartz.
4.	Elongately lanceolate, angled on both faces.	3⅜	1	½	Ditto; edges serrated.
5.	Ditto.	2⅛	1⅛	⅜	White opaque milky quartz.
6.	Foliolate.	1⅞	1	⅜	Smoky quartz.
7.	Ditto.	1½	⅞	⅜	Ditto; apex broken.
8.	Elongately lanceolate, flat on both faces.	[illegible]	1⅛	¼	Dirty olive-green banded quartzite; apex very sharp.
9.	Ditto.	3⅛	1¼	⅜	Brown-red (ferruginous) clay shale.
10.		1⅝	1	⅜	White chalcedonic quartz.
11.		2¼	1⅜	⅜	Ditto; poor specimen.

These figures show how very uniform in general the size of the spear-heads is; or, when there is a gradation, it is regular and gradual. The eleventh specimen is rough and unfinished, and the twelfth is hardly worth recording in detail.

Somewhat similar spear-heads are figured from the United States by Mr. T. Wilson, especially one with square jagged edges and marginal facets.*

Mr. Froggatt informs me that the Lennard River Blacks use these spear-heads almost wholly in personal attack and encounters, seldom in sporting, and that these extremely fine heads are carried about unmounted, and placed in position on the spears as required. They are carried in a chignon, made of emu feathers matted together, and attached to the back hair. The hair is worn long, similar to that of the Cooper's Creek natives, who do it up in a head-net.† Inside this chignon the spear-heads are wrapped in paper-bark. Thanks to Mr. Froggatt I have much pleasure in exhibiting one of these ingenious contrivances.

[redacted]

arched side bears traces of longitudinal facets. The apex is obtuse and chipped, and the section irregularly triangular.

If a spear-head, and I do not see any other possible interpretation, it is certainly different to any others I have seen from Northern Australia, and will probably form a separate group, following Nos. 1 and 2 in the classification given by me in the first account of the Kimberley spear-heads.* At the same time there is a certain resemblance between it and the fine long axe-head of flesh-coloured quartzite lately figured.†

xii.—*Spear-heads from Settlement Creek and Nicholson River.*
(Pl. IV., figs. 2 and 3.)

The three spear-heads now to be noticed are a part of the Queensland Museum Collection forwarded to me by Mr. De Vis. Two are made of a semi-granular flesh-coloured quartzite,‡ similar to but coarser than the knife first described from the Gregory River, and perhaps more akin to the stone of the axes from "North Queensland," in the Australian Museum. Both these spear-heads have still adhering to their bases portions of the gum used in mounting. One of them is six and three-quarter inches long, by one and a quarter wide; the other is shorter, six and a quarter long, and broader, being one and five-eighths wide. The section is triangular, flat, or partially concave on one face, acutely angular and sharp in the middle line on the other, tapering to a moderately acute apex.

The third spear-head is composed of a dark chocolate felsite with flesh-coloured orthoclase, and is slightly enlarged at the base

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* Records Geol. Survey N. S. Wales, 1890, II., Pt. 2, p. 65.

† Proc. Linn. Soc. N. S. Wales, 1890, V. (2), Pt. 3, Pl. 12, f. 14.

‡ The blacks near the Daly River, Arnheim's Land, are said by A. C. Gregory to possess spears formed of reeds with "large heads of white sandstone" (*Journals of Australian Exploration*, by A. C. and F. T. Gregory, 1884, p. 158, 8vo, Brisbane). It is possible that this rock may be similar to the quartzite described above. The use of the white man's materials for aboriginal weapons is again illustrated in the case of spear-heads. In the Queensland Court of the Indian and Colonial Exhibition of 1886 were fighting spears from the Etheridge River, pointed and barbed with pieces of telegraph wire, exhibited by Mr. W. Samwell, the Warden at Georgetown.

to afford a good grip to the cementing medium, portions of which still remain. It is six and three-eighths inches long, by one and two-eighths wide, with an acute apex. The median angular line is very acute, but at the base a large chip has been taken out of it (Pl. vi., fig. 3). One of the flesh-coloured heads, the shorter and broader, has a similar piece flaked off, but the longer of the two bears a narrow longitudinal facet, extending almost the whole length of the weapon, whilst at the apex there is a small supplementary triangular facet, and a larger one at the base. The cutting edges of all are sharp, but those of the felsite spear-head are naturally sharper; they are not strictly parallel edged in either, but there is a slightly flexuous or curved outline, which throws the apex more or less to one side, and renders it excentric to some extent. This curved appearance is well illustrated by Smyth in the case of a "knife" from the Paroo River,* the base of which is wrapt in 'possum fur, but otherwise the resemblance to our spear-heads is very strong.

xiii.—*Talismanic Stones, or Teyl.*

(Pl. VIII., figs. 4-6.)

The Teyl from Cooktown,* in the cabinet of Mr. G. Sweet of Brunswick, Melbourne, consisted of a mass of quartz crystals in one piece, and free of gum mounting. The present fine example (Pl. VIII., fig. 4) is again from Northern Queensland, and from the Queensland Museum Collection, and consists of two prismatic crystals of clear quartz united at the base by gum, and set alongside of one another. The cementing medium is rendered more coherent by being mixed with hair, which seems to be human. It would be exceedingly interesting to ascertain from what portion of the pilous system this hair is derived. According to Police-Trooper Gason the Dieyerie Tribe of South Australia use a belt of human hair called *Yinka*,† "ordinarily three hundred yards in length, and wound round the waist." It is said to be greatly prized owing to the difficulty of procuring the necessary material. Mr. Howitt also mentions that the Cooper's Creek natives wear a "very long cord wound round and round the waist like a belt,"‡ and I am informed by my colleague Mr. J. E. Carne, who has travelled extensively throughout that region, that the hair so used is pubic, obtained from the women, and only worn by the old men of the tribe. I quote these facts with the view of suggesting that the hair used in this *tael* may be similarly derived.

Mr. E. C. Blomfield, of Boorolong, has very kindly forwarded to my colleague Mr. W. Anderson, of the Geological Survey, three other *Taels*. The first of these consists of a small six-sided prism of slightly smoky quartz, with a fairly perfect termination. The crystal is one and a quarter inches long. The second stone is an irregularly shaped piece of clear white rock crystal (Pl. VIII., fig. 5) excentrically fractured, about half the size of a walnut. The third and fourth charms consist of opaque coffee-coloured quartz, one in the form of an irregular rhomb (Pl. VIII., fig. 6), the other

* *Ibid.* p. 370

† The Native Tribes of S. Australia, edited by J. D. Woods, 1879, p. 289; and Smyth's Aborigines of Victoria, 1878, I., p. 281.

‡ Smyth's Aborigines of Victoria, 1878, II., p. 302.

a transversely elongated pebble, two and a half inches long.* The angles of these stones are all well rounded, and they had evidently undergone considerable attrition before selection for their aboriginal use. The longest diameter of the largest is two and a half inches. Touching these stones, Mr. Blomfield makes the following remarks in his letter accompanying them :—"The specimens were obtained by my brother from an old blackfellow at Mount Mitchell, Eastern New England, who told him that they had belonged to the last 'medicine man' of the tribe, and as he was the last representative, and not a 'doctor,' he had no use for them, and seemed rather glad at being relieved of their charge. He told my brother on no account to let any blackfellow know that he had given them to him. I know that the 'medicine men' in all the tribes carry these stones and attach great importance to them, never showing them to a white man. I have been told by the blacks that if a gin dared to look at them, she would be instantly killed. They pretend to work all sorts of cures with these stones, and I believe they are

fragment of quartzite, firmly set into the end of a rough handle of wood, and secured in its place by gum." His example was seventeen inches in length. In the tool from the Queensland Museum more of the quartzite head is exposed than in Smyth's figure, and the handle, thirteen inches in length, is proportionately more slender and better finished, producing altogether a handier though slighter instrument. The handle is gently curved in the plane of the breadth of the chisel, so that the leverage of the operator's hand is much more increased than if the stick were straight. It is thickest in the middle, tapering off at both ends, and is composed, Mr. F. Turner tells me, probably of a species of *Myoporum*, one of the sandal-woods of the interior.

The small stone-head was produced by chipping, the lower side convex, the upper more or less flattened, and the cutting edge gently curved. The gum securing the head to the handle is curiously put on. On the convex face, or that side answering to the convexity of the handle, the largest amount of surface is left exposed, the edge of the gum curving from the cutting edge in a concave sweep. On the other side, or that answering to the concavity of the handle, the edge of the gum in the centre is horizontal, with a little lappet on each side projecting forwards.

According to Smyth* this implement is "commonly used by the natives inhabiting the country north-east of the Grey Ranges."

It is also met with in West Australia, for this author figures a larger instrument of a similar nature, but differing in detail. He remarks on this† :—"Below the lump of gum in which the stone is fixed, the implement for the length of an inch and a half is smooth ; then there is a hollow, and below that the round stick is grooved longitudinally, so as to enable the mechanic to obtain a firm hold of it. The wood is not heavy but very hard, and of a dark reddish-brown colour. It is used for cutting and shaping boomerangs, shields, clubs, &c., and is employed also in war and hunting. It is thrown in such a manner as to turn over in its flight, and if it strikes a man or a kangaroo death is certain." Smyth adds that the gouge resembles the implement used by the Grey

* Aborigines of Victoria, 1878, i., p. 379.
† *Ibid.* p. 340, f. 150.

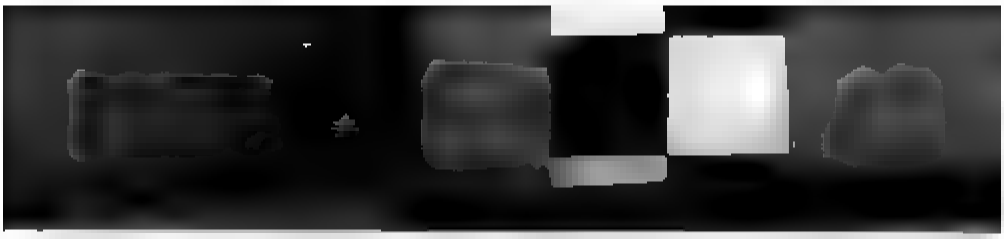
Ranges natives, but is a more finished tool. Herein it resembles the specimen from the Queensland Museum, but it stands to reason that so much slighter an instrument as the latter could not produce the effects ascribed to the heavier weapon from West Australia. In the last-named province it is called *Dow-ak* or *Dhabba.**

In his account of the Aborigines of Cooper's Creek,† Mr. A. W. Howitt refers to these gouges, and says that they are used "by the workman sitting down upon the ground, holding the piece of wood between his feet, and then adzing it, with the tool held towards him."

xv.—*Spike or awl.*

(Pl. vi., fig. 3.)

Although not a "stone" implement, this very interesting object, from amongst Mr. Froggatt's Kimberley gatherings, is worthy of notice. It appears to be of the nature of a spike or awl, and is formed of an old-fashioned cast-iron four-sided nail sharpened at one end and inserted in the proximal half of a human left



EXPLANATION OF PLATES *(continued)*.

Plate v.

Fig. 1.—Knife, granular flesh-coloured quartzite; North Queensland. Coll. Queensland Museum.

Fig. 2.—Spear-head, elongately lanceolate, with serrated edges, of white opaque milky quartz; Kimberley. Coll. Froggatt.

Fig. 3.—Gouge; Northern Queensland. Coll. Queensland Museum.

Plate vi.

Fig. 1.—Knife, bottle-glass mounted on wooden handle *(Acacia sentis)* with black gum; Northern Queensland. Coll. Queensland Museum.

Fig. 2.—Spear-head, elongately lanceolate; of bottle-glass serrated on edges; Kimberley. Coll. Froggatt.

Fig. 3.—Awl (?) formed of a cast-iron four-sided nail inserted in the proximal half of a human left radius; Kimberley. Coll. Froggatt.

Plate vii.

Fig. 1.—Knife, of streaky flint-like quartz, broad along the back, mounted in old canvas and twine, and secured with black gum composition, which extends along the back; Northern Queensland. Coll. Queensland Museum.

Fig. 2.—Spear-head, elongately lanceolate, of white opaque milky quartz; edges unserrated; Kimberley. Coll. Froggatt.

Fig. 3.—Spear-head, elongately lanceolate, and with a very sharp apex; Kimberley. Coll. Froggatt.

Plate viii.

Fig. 1.—Spear-head, white opaque milky quartz, and edges serrated; Kimberley. Coll. Froggatt.

Fig. 2.—Spear-head, white chalcedonic quartz; Kimberley. Coll. Froggatt.

Fig. 3.—Spear-head, foliolate, of smoky quartz; Kimberley. Coll. Froggatt.

Fig. 4.—*Teyl*, of two prismatic crystals of clear quartz, held together by gum cement mixed with hair; North Queensland. Coll. Queensland Museum.

Fig. 5.—*Teyl*, irregular shaped clear rock crystal; New England. Coll. Mining and Geological Museum.

Fig. 6.—*Teyl*, rhomb of opaque coffee-coloured quartz; New England. Coll. Mining and Geological Museum.

NOTES AND EXHIBITS.

Mr. Etheridge showed a fine collection of aboriginal stone knives and implements in illustration of his paper.

Mr. Olliff exhibited specimens of the butterfly described in his paper

Mr. Musson showed a named collection of about sixty species of New Zealand mosses.

Mr. Hedley showed a colony of the nests of a trap-door spider, together with specimens of the animal, from Rose Bay. These spiders are abundant round Sydney, occurring even in the public parks of the city. A favourite spot for them is a patch of mossy earth in the crevice of a sandstone rock. The species exhibited forms a wafer-like lid, not as in some species a thick door like a gun-wad. The presence of several egg-bags in the larger burrows would indicate that the present month (February), is the breeding season.

Mr. Fletcher exhibited two specimens of a land planarian (*Bipalium kewense*, Moseley), collected by Mr. J. J. Lister at Upolu, Samoa, under stones in the bush; and a specimen of the same species from Eltham, Victoria, collected by Mr. W. W. Smith; seeing that this planarian has now undoubtedly been introduced into many widely separated localities, and that the

WEDNESDAY, 15TH MARCH, 1891.

The President, Professor Haswell, M.A., D.Sc., in the Chair.

Mr. Oswald B. Lower, Adelaide, was elected a member of the Society.

DONATIONS.

"Gesellschaft für Erdkunde zu Berlin—Verhandlungen." Bd. xvii., Nos. 8-10; "Zeitschrift." Bd. xxv., Heft 5 (1890). *From the Society.*

"The Australasian Journal of Pharmacy." Vol. VI., No. 62 (Feb., 1891). *From the Editor.*

"Report of the Board of Governors of the Public Library, &c., of South Australia, 1889-90." *From the Board.*

"Zoologischer Anzeiger." xiv. Jahrg., Nos. 354 (Jan. 9, 1891), and 355 (Feb. 2, 1891). *From the Editor.*

"Comptes Rendus de Séances de l'Académie de Paris." T. cxi., Nos. 24-26, T. cxii., Nos. 1 and 2 (1891). "Tables des C. R." T. cx. (1890). *From the Academy.*

"Perak Government Gazette." Vol. IV., Nos. 1-3 (Jan., 1891). *From the Government Secretary.*

"Zoological Society of London.—Abstracts." Jan. 6, 1891, Jan. 20, 1891, and Feb. 3, 1891. *From the Society.*

"Reports and Statistics of the Mining Department, Victoria, for Quarter ended Dec. 31st, 1890." *From the Secretary for Mines.*

"List of Canadian Hepaticæ" By W. H. Pearson. *From the Author.*

Asiatic Society of Bengal.—"Journal." Vol. lviii. (1889), Part i., No. 3; Part ii., No. 5; Vol. lix. (1890), Part ii., Nos. 2 and 3.—"Proceedings, 1890." Nos. 4-10 (April-December). *From the Society.*

"Mémoires de la Société des Naturalistes de la Nouvelle Russie, Odessa." Tome XV., No. 2 (1890). *From the Society.*

"Reichenbachia.—Orchids illustrated and described." By F. Sander. Second Series, Vol. I., Part 3. *From the Hon. Sir William Macleay, M.L.C., F.L.S.*

"Entomologisk Tidskrift." Arg. x., Häft 5 (1889); Arg. xi., Haft 1-4 (1890). *From the Entomological Society of Stockholm.*

"Annales de la Société Géologique de Belgique." T. XVI., 2e Livr; T. XVII., 4e Livr. *From the Society.*

"Annali del Museo Civico di Storia Naturale di Genova." Série 2ª, Vols. VII.-IX. (1889-90). *From the Museum.*

"Mémoires de la Société Zoologique de France pour l'Année 1890." T. iii., Part 4; "Bulletin." T. xv., No. 10. *From the Society.*

"Report of the Auckland Institute and Museum for 1890-91." *From the Secretary.*

"Notes on a new Tasmanian Plant of the N.O. *Burmanniaceæ.*" By Baron von Mueller, K.C.M.G., F.R.S. (Advance copy). *From the Royal Society of Tasmania.*

"Victorian Naturalist." Vol. vii., Nos. 11 and 12 (in one, March and April, 1891). *From the Field Naturalists' Club of Victoria.*

"Journal of Comparative Medicine and Veterinary Archives." Vol. XII., No. 1 (Jan., 1891). *From the Editor.*

"American Naturalist." Vol. XXIV., No. 288 (Dec., 1890). *From the Editors.*

"Bulletin of the American Geographical Society." Vol. xxii., No. 4 (Dec., 1890). *From the Society.*

"Bulletin of the Museum of Comparative Zoology at Harvard College." Vol. XX., Nos. 5-7. *From the Curator.*

Pamphlet (4to) entitled "Sculptured Anthropoid Ape Heads, &c." By James Terry. *From the Author.*

"Journal of Morphology." Vol. IV., No. 2 (Oct., 1890). Pamphlet entitled "Ueber *Temnocephala,* Blanchard." Von Max Weber. *From Professor Haswell, M.A., D Sc.*

"New Zealand Journal of Science." Vol. I., n.s., No. 2 (March, 1890). *From the Publishers.*

"Insect Life." Vol. V., No. 3 (Jan., 1891). *From the Secretary, U.S. Department of Agriculture.*

"Quarterly Journal of the Geological Society, London." Vol. XLVII., Part 1 (1891). *From the Society.*

"Annales de la Société Belge de Microscopie," T. XIV. (1890); "Bulletin." T. XIV.-XVI. (1889-90). *From the Society.*

"Report of the Second Meeting of the Australasian Association for the Advancement of Science, held at Melbourne, 1890." *From the Association.*

ON THE CLASSIFICATION OF EUCALYPTS.

By W. Woolls, Ph.D., F.L.S.

No genus, whether in reference to the identification of species, or the arranging of them in groups, has given more trouble to botanists than that of *Eucalyptus*. In the early days of the colony, when only a few species were known, it was considered that they might be divided into sections according to the shape of the operculum or lid of the flower-buds, and hence Willdenow in his *Species Plantarum* (1799) arranges all the species then known, amounting only to 12 in number, under the two divisions (1) operculo conico, and (2) operculo hemisphærico.

With the exception of *E. obliqua*, L'Héritier (which, according to Baron F. von Mueller, was the first of all the species rendered known in Europe, having been collected in Tasmania shortly before the foundation of the colony of N. S. Wales), the species recorded by Willdenow were found in the primeval forests around Port Jackson, probably on the spot where Sydney now stands. His list is as follows:—

(1) Operculo conico.

E. robusta, Sm.	*E. resinifera*, Sm.
E. pilularis, Sm.	*E. capitellata*, Sm.
E. tereticornis, Sm.	*E. saligna*, Sm.

(2) Operculo hemisphærico.

E. botryoides, Sm.	*E. obliqua*, L'Hér.
E. hæmastoma, Sm.	*E. corymbosa*, Sm.
E. piperita, Sm.	*E. paniculata*, Sm.

(1) As far as can be ascertained from the short descriptions of these species, *E. robusta* is known by the popular name of "Swamp

Mahogany;" *E. pilularis*, "Blackbutt"; *E. tereticornis*, "Grey Gum"; *E. resinifera*, first of all "Red Ironbark," but according to the *Flora Australiensis* "Red Mahogany"; *E. capitellata*, the coast form of "Stringy-bark;" and *E. saligna*, "Blue or Flooded Gum." The specific name is not appropriate, as the leaves are only exceptionally narrow and willow-like, being generally of the size and form represented in Baron Mueller's *Eucalyptographia* (Vol. I., Dec. 2).

(2) *E. botryoides* is known as "Bastard Mahogany"; *E. hæmastoma*, "White Gum"; *E. piperita*, "Peppermint"; *E. obliqua*, the form of "Stringy-bark" common to Tasmania, Victoria, and the southern part of N. S. Wales; *E. corymbosa*, "Blood-wood"; and *E. paniculata*, "White Ironbark."

The plan of arranging the species according to the shape of the operculum was followed by D'CANDOLLE with certain modifications; and GEORGE DON, F.L.S., in enumerating the species in 1832, [redacted]

*** Operculum nearly conical or hemispherical, shorter than the cupula.

18. *E. ovata*, Labill.
19. *E. scabra*, Dum. Cours.
20. *E. pilularis*, Sm.
21. *E. radiata*, Sieb.
22. *E. stricta*, Sieb.
23. *E. hæmastoma*, Sm.
24. *E. ligustrina*, DC.
25. *E. amygdalina*, Labill.
26. *E. ambigua*, DC.
27. *E. Lindleyana*, DC.
28. *E. botryoides*, Sm.
29. *E. piperita*, Sm.
30. *E. pallens*, DC.
31. *E. obliqua*, L'Hér.
32. *E. corymbosa*, Sm.
33. *E. paniculata*, Sm.
34. *E. gneorifolia*, DC.
35. *E. obtusifolia*, DC.

**** Operculum hemispherical, much broader than the cupula.

36. *E. gomphocephala*, DC.

***** Mature operculum depressed in the centre, where it is umbonate, shorter than the cupula.

37. *E. globulus*, Labill.

II. Oppositifoliæ.

38. *E. diversifolia*, Bonpl.
39. *E. pulvigera*, Cunn.
40. *E. cordata*, Labill.
41. *E. pulverulenta*, Sims

Doubtful Species.

* Leaves opposite.

42. *E. glauca*, DC.
43. *E. purpurascens*, Link
44. *E. tuberculata*, Parm.
45. *E. Cunninghami*, Don
46. *E. rigida*, Hoff.
47. *E. hypericifolia*, Dum. Cours.

** Leaves alternate.

48. *E. microphylla*, Willd.
49. *E. stenophylla*, Link
50. *E. myrtifolia*, Link
51. *E. elongata*, Link
52. *E. media*, Link
53. *E. reticulata*, Link
54. *E. umbellata*, Dum. Cours.

No change was proposed for the classification of the Eucalypts until 1858, when Baron Mueller, in a paper read before the Linnean Society, suggested what may be termed the "cortical system," or a mode of arranging the species according to the structure of the bark, whilst at the same time he directed attention to the valves of the fruit as affording an additional character for the identification of species. The Baron's monograph refers especially to the Eucalypts of tropical or sub-tropical Australia, but the suggestions contained in it may be applied to the whole genus, and they have certainly proved exceedingly useful in determining species previously doubtful, and of showing that the comparative length of the operculum is not always a safe guide.

The Baron, in offering the cortical system as a contribution towards the better arrangement of the Eucalypts, speaks of it as one accommodated to the use of the colonists, regarding it evidently as a popular way of grouping the species according to their appearance in a living state, and of ascertaining whether it might

I. Leiophloiæ.

1. *E. tereticornis*, Sm.
2. *E. rostrata*, Schlecht
3. *E. signata*
4. *E. variegata*
5. *E. citriodora*, Hook.
6. *E. brevifolia*
7. *E. dichromophloia*
8. *E. hemilampra*
9. *E. bigalerita*
10. *E. latifolia*
11. *E. platyphylla*
12. *E. aspera*

II. Hemiphloiæ.

13. *E. tessalaris*
14. *E. semicorticata*
15. *E. confertiflora*

III. Rhytiphloiæ.

16. *E. polycarpa*
17. *E. terminalis*
18. *E. tectifica*
19. *E. leptophleba*
20. *E. microtheca*
21. *E. patellaris*
22. *E. trachyphloia*
23. *E. bicolor* A.C.
24. *E. populnea*
25. *E. ferruginea*

IV. Pachyphloiæ.

26. *E. fibrosa*
27. *E. exserta*
28. *E. ptychocarpa*
29. *E. tetrodonta*

V. Schizophloiæ.

30. *E. crebra*
31. *E. melanophloia*

VI. Lepidophloiæ.

32. *E. aurantiaca*
33. *E. phœnicea*
34. *E. melissodora.*

Sectio dubia.

35. *E. brachyandra*
36. *E. clavigera*, A.C.
37. *E. odontocarpa*
38. *E. pachyphylla*

As a further assistance in describing species of Eucalyptus, the Baron next suggested that attention should be paid to the shape and opening of the anthers; and in his *Fragmenta Phytographiæ Australiæ*, Vol. II. (1861), in which he devoted 38 pages to the consideration of the genus, he notes particularly the form and colour of the anthers. I am not aware that any previous botanist

had noticed with a view to classification that the variations in the stamens afforded a means whereby species might be grouped together; but Mr. Bentham, in arranging the species of Eucalyptus in the *Flora Australiensis*, not only described with accuracy the form of the anthers in each species, but made the variations a basis for the elaboration of his anthereal system. In the *Flora*, Vol. III. (1866), that eminent botanist tells us of the difficulties he had experienced in grouping the species. The comparative length of the operculum, the shape and position of the leaves, the character of the inflorescence and fruit, and the nature of the bark (of which in dried specimens he was totally unable to judge), had all failed to give him a satisfactory mode of classification. He says:—"I have thus been compelled to establish groups upon such characters as appeared to me the most constant among those which are supplied by the specimens: in *the first place upon the form of the anthers*, and secondly upon that of the fruit, and in some cases on the inflorescence or the calyx." It is evident that Mr. Bentham regarded his arrangement as simply provisional, for he expresses a

In his preface to the *Eucalyptographia*, 1880, (in which 100 species are figured and described), Baron Mueller has adopted Mr. Bentham's system, with certain modifications, for all the Eucalypts in Australia. Whilst still retaining the opinion that the "cortical system" is useful for work in the field, he recognises the anthereal system as most convenient for arranging specimens in the museum. Without, however, finally arranging his figures according to any fixed plan, the Baron says, that, on full consideration, he has deemed it best to leave the lithograms unnumbered, so that any one who "had occasion to utilise his work might arrange the plates either in accordance with the method derived from the stamens, or according to the cortical system, or, if he should think it more convenient, alphabetically."

The anthereal system, as modified by the Baron, is thus explained:—

I. —*Renantheræ* }
II. —*Porantheræ* } as already indicated in the *Flora*.

III.—*Strongylantheræ*, having anthers not or scarcely longer than broad, usually round, opening by longitudinal slits.

IV.—*Orthantheræ*, having anthers distinctly longer than broad, opening by almost parallel slits.

In tracing the study of *Eucalyptus*, it may be seen how difficult it is to fix on any peculiar characters for the determination and grouping of species. Before R. Brown had visited these shores and had returned to Europe with 4000 specimens of plants almost new to science, few species of Eucalypts were known. Nor do they appear to have received much addition from the labours of that eminent man, for as his collections were made either at Port Jackson, or on the coasts of Australia when voyaging with Flinders (1801-1805), he had no opportunity of discovering any inland species. Brown, however, was the first to notice that some of the Eucalypts had a double operculum, the outer, in his opinion, being in the form of a calyx, and the inner in that of a corolla. The species connected with his name are:—

E. calophylla, R.Br.; Western Australia.

E. grandifolia, R.Br.; Northern Australia.

E. perfoliata, R.Br.; Northern Australia.

E. Baxteri, R.Br.; probably from Kangaroo Island, and now regarded as a variety of *E. santalifolia*, F.v.M.

E. hypericifolia, R.Br.; from Risdon Cove, Tasmania, and now joined with *E. amygdalina*, Labill.

E. Risdoni, Hook.; collected by Brown at Risdon Cove.

E. clavigera, A. Cunn.; collected by Brown at Careening Cove, Northern Australia.

CALEY, who resided in Parramatta from 1800 to 1810, when only a small portion of the colony was known, could not have noticed any of the Eucalypts excepting in those parts now distinguished as the County of Cumberland and Hunter's River, so his name does not appear to be connected with the genus. Caley's time was not exclusively devoted to botany, for he made valuable collections in every department of natural history. It appears that he was the first to send to Europe specimens of the "Red-flowering Ironbark," and the large variety of the "Swamp Mahogany." He also collected specimens of the following

Dividing Range. He accompanied Lieut. OXLEY, then Surveyor-General of the colony, in his expedition to explore the Lachlan in 1817, and subsequently visited Liverpool Plains by a practicable pass over the Range. In these expeditions he discovered several new species, whilst about the same period SIEBER appears to have collected specimens on the Blue Mountains. CUNNINGHAM was indefatigable in sending collections to Europe, but such was the apathy of those days in reference to botanical discoveries in Australia, that many of his packages remained unopened for nearly a quarter of a century; and it was not until Mr. BENTHAM was engaged in preparing, with the assistance of Baron MUELLER, his great work on the Flora of Australia, that CUNNINGHAM's labours were in any way appreciated. It must be admitted that the genus *Eucalyptus* was not a favourite with our early botanists. They found so much difficulty in distinguishing one species from another, that it used to be said the workmen at Port Jackson knew more about the different kinds of Eucalypts than those who endeavoured to define species by the usual characters. Even within my recollection, it was maintained by some that many of what are now regarded as species were simply varieties, whilst it was asserted by others that a process of hybridisation was going on amongst them. In the English Encyclopædia, which was published in 1851, a writer remarks "in many species the leaves are so variable in their form and other characters at different ages of the tree, or in different situations, that it is a matter of difficulty to know how they are to be botanically distinguished from each other; and in fact the subject of the distinction of species has hardly yet been taken up, no botanist feeling competent to undertake the task without some personal acquaintance with the plants in a native state. The leaves, instead of presenting one of their surfaces to the sky and the other to the earth, as is the case with the trees in Europe, are often arranged with their faces vertical, so that each side is equally exposed to the light." He then goes on to lament over the difficulty of understanding the names by which the colonists call Eucalypts in different parts of Australia, and expresses a wish that some settled nomenclature may be introduced.

The labours of BENTHAM and MUELLER have formed a new era in the history of *Eucalyptus*. They have enabled us to identify species but little known a quarter of a century ago, and to refer to their proper places in a systematic arrangement all the known Eucalypts. It is to be hoped, therefore, in due course that a "settled nomenclature" may be devised, and that the obscurities arising from "local names" may be cleared up. In reviewing the different modes adopted for describing and grouping the species, it will be seen that, whilst some of the former characters have been abandoned, or are now only partially relied on, the cortical and anthereal systems have thrown much light on a subject which all botanists, from the days of BROWN to the present time, have regarded as beset with many difficulties.

The first mode of arranging species, as already stated, was founded on the comparative shape and length of the operculum. This method, if adopted only in arranging the specimens of the last century, is now found to be misleading, for the operculum of *E. [illegible]* is sometimes [illegible] and sometimes hemispherical, and

leaves, and they recognise the difficulty of relying on brief descriptions, which, according to the judgment of different observers, were sometimes applied to very different trees. In referring to some of the lists which were published half a century since, it is amusing to notice the mistakes that occurred in the misapplication of botanical names. Thus, for instance, the blue-gum (*E. saligna*) was referred to *E. piperita*, or the peppermint; the stringy-bark (*E. capitellata* or *E. eugenioides*) to *E. robusta* the swamp mahogany; white gum (*E. hæmastoma*) to *E. tereticornis*, grey gum or bastard box; and spotted gum (*E. maculata*) to *E. hæmastoma*. It is no wonder that the systematic arrangement proved so fallacious, when it is considered that the operculum, even in the same species, is subject to variation, and that the leaves are of various shapes and sizes on the same kind of trees. This is seen in some species more than in others, whilst, as Mr. Bentham found, as the result of long observation, that no sure diagnostic characters could be taken from such sources. It is true that in some species the venation is well defined, and that even a few may be determined by the shape of the leaf, but these are exceptional cases; and perhaps of all known genera no genus affords less assistance to the systematic botanist in the character of its foliage than *Eucalyptus*. When, therefore, so many difficulties presented themselves from previous endeavours to classify our Eucalypts, Baron Mueller's plan of grouping them according to the nature of their bark was hailed with satisfaction by observers in these colonies. The system, it is true, cannot be appreciated by European botanists, or those who have not an opportunity of seeing the trees in a living state; but to persons who are studying the species as they appear in their native forests, it affords an easy method of referring them to a recognised position. Besides, the terms "Gums," "Stringy-barks," and "Iron-barks" are so natural and familiar to the colonists, that any system founded on the smooth, fibrous, or rugged character of the bark, commends itself to them. The cortical system, therefore, has proved a step in the right direction, and it may be regarded as a popular method of overcoming some portion of the difficulty which has attended

the study of our Eucalypts. But, after all, as the learned Baron himself would acknowledge, the system is only an instalment towards the object sought after, for as certain trees are as variable in their bark as others are in their leaves, his sectional arrangement does not hold universally. There are exceptions, for instance, to the *Leiophloiæ*; for *E. hæmastoma*, *E. saligna*, *E. viminalis*, *E. stellulata*, and *E. punctata* are sometimes half-barked, whilst instances occur in which *E. tereticornis* has fibrous bark. The different kinds of Box are not always half-barked, and so some of the *Hemiphloiæ* incline to the *Leiophloiæ* in extreme age. I have noticed this peculiarity in *E. largiflorens*, and in some of the blackbutts (*E. pilularis*). The fibrous-barked trees, such as blood-wood, stringy-bark, and mahogany, are less liable to variation in the bark; but in the woolly-butt (*E. longifolia*), of which the Baron regards the bark as wrinkled, somewhat fibrous and persistent, I have seen old trees which might have been mistaken for *E. tereticornis*, their trunks having completely shed their bark and become similar to gum trees. This shows how

years, it is only of late that I have come to the conclusion that the tree in question is really an iron bark, for on Mr. H. Bray's property at Concord a similar one has been pointed out to me. This the workmen called "Bastard Iron-bark," as the wood resembles that of iron-bark, whilst the bark is not furrowed as iron-barks usually are, but is more like that of box or woolly-butt. Having examined the fruit and leaves of this tree, and having ascertained that the wood is similar to that of iron-bark, I am now convinced that the tree which puzzled Mr T. Shepherd and that growing in Mr. Bray's paddock are identical, both of them being varieties of *E. paniculata.* If hybridisation were possible in the genus, one would think that the "Iron bark Box" is a cross between iron-bark and box, but according to the opinion of the late eminent naturalist W. S. MACLEAY, F.L.S., the impregnation of the flowers takes place before the operculum falls off, and hence in such a case crossing cannot be effected. As this matter has never been carefully investigated by any observer, nothing like certainty can be affirmed of the probability or improbability of hybridisation. If, indeed, such a contingency might be supposed, it would relieve us of many difficulties in the fixing of species, and lead to the belief that some of the forms which resemble each other closely in flowers and fruit, but differ only in wood and bark, are merely varieties. If nature does not admit of crossing in the genus *Eucalyptus*, it certainly encourages that of grafting, for, in the neighbourhood of Mudgee, "the Apple" *(Angophora intermedia)* may be seen grafted naturally on *E. rostrata*, whilst, on the Richmond Common, a similar eccentricity may be seen on *E. tereticornis.* Whatever may be discovered, however, in reference to natural changes which may be going on amongst our Eucalpyts, Baron Mueller's cortical system is one of the greatest utility, for although there are exceptional cases in which there is some uncertainty from variation of the bark in the same species, yet, generally speaking, his grouping can be maintained, and in cases where the bark seems abnormal or differing from the ordinary type, mistakes may be obviated by an examination of the flowers and fruits.

The anthereal system, which was in some degree suggested by Baron Mueller's descriptions in his *Fragmenta*, and was subsequently worked out with great ingenuity by Mr. Bentham in the *Flora Australiensis*, is that now generally adopted by botanists. The Baron, in his preface to his *Eucalyptographia*, expresses the opinion that it is most convenient for the arranging of specimens in herbaria, and that the method brings also into close contact most of the Eucalypts which are bound together by natural affinity. But whilst these great men have rendered incalculable assistance in the classification of the genus, it remains for further investigation to clear up the anomalies which still exist in the anthereal system. Though as a system for grouping the species it proves so useful, yet it must be confessed that it is not so satisfactory to the general observer, or to one who has not the leisure for microscopic investigations. When the anthers are small or in their configuration vacillating between two sections, a powerful lens or even a microscope may be necessary for accurate determination. [redacted]

appearance. But these irregularities, as they would be popularly regarded, are of much less importance than mistakes which have arisen from a too rigid application of the anthereal system without reference to the bark, wood, or habits of certain trees. In the excellent "Forest Flora of South Australia" by Mr. J. E. BROWN, F.L.S., two such instances occur, the first in *E. leucoxylon*, F.v.M., and the second in *E. paniculata*, Sm. The former of these is called in South Australia "White Gum," "Blue Gum," and "Pink Gum," and from the character of its bark it stands in the Baron's *Leiophloiæ*. Its specific name denotes that the wood is white, and the tree is said to assume a variety of forms. Now, by adhering too strictly to the anthereal system, this gum tree is said to be identical with our "Red-flowering Iron-bark" of Eastern Australia, a tree remarkable for the dark colour of its wood, and the deep fissures of its rough bark. There is certainly great similarity in the flowers and fruit, but to those who have had opportunities of seeing the two trees in their native forests, it seems marvellous that they should be regarded as the same species. Our red-flowering iron-bark is Cunningham's *E. sideroxylon*, and I believe that Baron Mueller now recognises it as such. *E. paniculata* is called in South Australia the panicle-flowered "White Gum," a small tree never found to exceed 30 or 40 feet, having deciduous bark, light-coloured wood, and a stunted spreading habit. There can be no doubt that the true *E. paniculata* belongs to Port Jackson, as it was one of the first of which specimens were forwarded from N. S. Wales to Europe, and which, since the publication of the *Flora Australiensis*, has been identified as the "Pale or White Iron-bark" (so called to distinguish it from the iron-barks with darker wood). This tree rises to 100 feet and upwards, has very tough wood, persistent bark, and an upright habit. The two trees, notwithstanding the close resemblance of flowers and fruit, must be regarded as two distinct species. Another instance occurs in *E. polyanthema*, under which the "Poplar-leaved Box" or "Lignum vitæ" of the low country is confused with the "Red Box or Slaty Gum" beyond the Dividing Range. The trees differ very much from each other in bark, wood, and habit, for whilst

that of the low country is a small tree with hard dark-coloured wood and little esteemed, the "Red Box" beyond Mudgee is a fine tree with wood highly valued in the building of bridges, &c.

In the consideration of specific differences, little stress has been laid on the nature and position of leaves, because they are so variable even in the same species. It is true that some have alternate, and some opposite leaves, and some have the leaves opposite when young, and alternate as they grow older; but these variations do not afford any character for sectional division. The trees which have opposite leaves are chiefly :—

E. pulverulenta (including *E. cinerea*)	*E. tetragona* (nearly so)
E. melanophloia	*E. odontocarpa* } (opposite or alternate)
E. cordata (Tasmania)	*E. tetrodonta* } (opposite or alternate)
E. macrocarpa	*E. gamophylla*
E. perfoliata	*E. setosa*
E. erythrocorys (nearly so)	*E. pruinosa* (nearly)
	E. doratoxylon (nearly)

Those which have the leaves opposite when young are :—

[redacted]

its age, and that even in some cases one side of a tree has better wood than the other. The soil also is said to affect the character of the wood. Without seeing the bark as well as the wood, even experienced men are deceived, and I have heard of cases in which inferior species have been passed off as iron-bark for railway sleepers.

The late lamented Tenison-Woods, F.G.S., F.L.S., who had paid considerable attention to the genus *Eucalyptus*, was of opinion that much might be done by studying the shape, size, and peculiarities of the seeds, and he had commenced collecting them with that view. There are great differences in the seeds, as may be seen by the figures in Baron Mueller's *Eucalyptographia*, and of the 100 species there illustrated, the following have a membrane or wing attached to them.

E. abergiana.	*E. tetragona.*
E. pachyphylla.	*E. ficifolia.*
E. corymbosa.	*E. oldfieldii.*
E. setosa.	*E. gamophylla.*
E. ptychocarpa.	*E. pyriformis.*
E. foelscheana.	*E. santalifolia.*
E. todtiana.	*E. tessalaris.*

It is well to place on record any further differences that may be noticed, as they may serve as notes for the fixing of species; but probably nothing is of greater importance than the shape of the fruit, the position of the capsule, the number of its cells, and the appearance of the valves. Some years ago, when writing about Eucalyptus, I remarked that, "viewed practically, Baron Mueller's method of grouping our Eucalypts, according to the nature and texture of the bark, is the best system which has yet been promulgated; and whilst future observations may render it more precise by defining with accuracy the particular group under which each species should be ranged, the basis of the system is likely to be permanent." The anthereal system had not then been elaborated, nor was I aware that the cortical system was liable to any serious exceptions. I do not see, however, any reason to alter the opinion I expressed, for by paying more attention to the figure and openings of the anthers than was thought of at that time, any

mistakes arising from the abnormal state of the bark may be rectified. To the passage already quoted I added, "As regards the fixing of species and of ascertaining the amount of variation to which some are liable, other principles must be applied. Some species, indeed, are marked by the double operculum, some by winged seeds, and others by the colour of their stamens; but the shape, cells, valves, &c., of the seed-vessels present very important notes of distinction and deserve the most attentive study. Hence I believe that these considerations, when taken in connection with the cortical group to which the respective species belong, will be found most efficacious in settling many difficulties." Since 1860, Baron Mueller has made wonderful progress in the description of new species and in illustrating their peculiar properties, but I still think that if any further improvement is to be made in the matter of classification, it must be by the study of their fruits. To collect the fruits of all known Eucalypts, and to form groups on the basis I have suggested, would be the work of time and might need almost a specialist; but if it be true, as the Baron is fond of saying,

THE LAND MOLLUSCAN FAUNA OF BRITISH NEW GUINEA.

By C. Hedley, F.L.S., Corr. Mem.

(Plates ix.-xii. and xii. *bis.*)

To naturalists generally the "Land of the Bird of Paradise" has ever been a source of interest, but to Australian students such a land, whose past history is intimately bound up with that of our own continent, should be especially attractive. Many archaic forms doubtless survive in that vast unknown region whose mountains, the loftiest in Australasia, possess every climate from the cold zone above the tree line to the tropical jungles of the littoral. Twenty years ago the coast of British New Guinea was a blank on the map, being less known than that of any country outside the Polar regions, and to-day the interior is almost entirely unexplored. What scanty information we possess concerning its fauna and flora is, therefore, of recent date. The first fruits of the conchological harvest were gathered by the naturalists of H.M.S. "Rattlesnake," who visited the Louisiades in 1849-50, and described by Forbes in an appendix to the account of that voyage. Sir W. Macleay, in 1875, touched at Yule Island in the "Chevert," in which neighbourhood many new species were obtained by his staff, descriptions of which by Brazier will be found in the earlier volumes of this Society's Proceedings. During the same and following years D'Albertis amassed, both on Yule Island and the Fly River, a fine collection of mollusca which were subsequently treated of by Tapparone-Canefri (Annali del Museo Civico di Genova, xix.). A trader and collector, Mr. A. Goldie, procured many shells during various excursions along the coast and in the interior, most of which went to the British Museum, and were described by Smith in the Annals and Magazine of Natural History. In 1889 a

collection was made by Sir W. Macgregor's party in the Louisiades; this was presented to the British Museum and was also described by Smith.

British New Guinea comprises the south-eastern quarter of Papua with the adjacent reefs and islands, except those falling within the Queensland boundary, between the meridians of 141° and 155° of E. longitude, and the parallels of 8° and 12° of S. latitude. Though these political boundaries do not form the natural limits of the fauna, it will be more convenient to restrict ourselves to the consideration of the mollusca of the British province. For while the collections made in foreign colonies are described by foreign writers in a foreign language, and the types deposited in more or less inaccessible museums, the specimens obtained in the British area are naturally referred to British or Australian naturalists. Information regarding this fauna is so scattered through various publications that I believe that I have consulted the convenience of future inquirers by adding to the results of my own researches a summary of the labours of my

Australian Museums respectively. To Mr. Brazier I am particularly obliged for much information, assistance in determining species, and for the loan of notes, papers, and specimens.

The land shells of the province exhibit four rather distinct geographical divisions :—

(a) The alpine fauna, whose sole known member is *Rhytida globosa*. Judging from the flora of these altitudes, as studied by Baron von Mueller (Trans. Roy. Soc. Vic. I. pt. 2, p. 1), the mollusca will probably exhibit affinities with those of Tasmania or Victoria. *Cystopelta* and *Paryphanta* are forms whose discovery may be anticipated.

(b) Secondly, that region lying between Port Moresby and the Fly River. Typical of this area are *Hadra broadbenti*, *Geotrochus taylorianus*, and *Helicina coxeni*. From this fauna the tropical mollusca of Queensland were perhaps derived, the colonists migrating across the dry bed of Torres Straits. Proceeding along the coast eastwards from Hula and Aroma to Orangerie Bay, we pass through a district quite unknown.

(c) A third province commences at South Cape Island in the west and includes all the eastern extremity of New Guinea with the outlying islands of Loggia, Samarai, Sarabai, Seidea, and Basilaki, or as they were formerly called Heath, Dinner, Hayter, Basilisk, and Moresby. I believe that the north east coast will fall within this province whose typical members are *Hadra rehsei*, *Nanina hunsteini*, and *Geotrochus brumeriensis*.

(d) The fourth fauna inhabits the Louisiade, the Dentrecasteaux,* the Trobriand, and the Woodlark Archipelagos. Characteristic forms are the Geotrochi allied to *louisiadensis*, and the gigantic Pupinellæ allied to *grandis*. Of some species, *Nanina divisa*, *Chloritis lesi*, and *Helicina insularum* for example, each island appears to possess a form, generally a variation peculiar to it. Many species have, through the blunders of unscientific collectors, been ascribed to the Dentrecasteaux Islands. I have

* The spelling of this name here adopted is not the version usually accepted but that of the official account of Dentrecasteaux's Voyages.

myself collected *G. rollsianus* and *P. brazieræ* upon Fergusson Island, and these, with the ubiquitous *L. vitreum*, are the only land shells yet known as indigenous to the group. These two characteristic forms would indicate that the fauna of these magnificent mountain islands will prove to be related rather to that of the distant Louisiades than to that of the nearer mainland.

1. Oxytes hercules, n.sp.

(Plate IX., figs. 1-2.)

Shell narrowly perforate, solid, large, orbicular, depressed, sharply keeled at the periphery; colour, above brownish-yellow, darkening as the whorls increase, on the base chestnut radiately painted with brownish-yellow, these tints reside solely in the epidermis beneath which the shell is livid, peristome pink; whorls 6½, slowly and regularly increasing, above flattened; sculpture, first three whorls nearly smooth showing minute granulations

This fine shell, the largest yet discovered in New Guinea, is, with the following species, closely allied to *N. doriæ*, T.-C., and probably to *H. achilles*, Braz. Unfortunately my specimens consist only of dead shells, and as Tapparone gives no anatomical characters, the generic position of the group remains a matter of conjecture.

2. O. FLYENSIS, n.sp.

(Plate IX., figs. 3-4.)

Shell hardly perforate, solid, large, orbicularly turbinate, acutely angled at the periphery, angle disappearing in the latter part of the last whorl; colour shell white, a broad black band edged below with reddish-brown encircling the base beneath the periphery, epidermis olive-green through which the peripheral band is visible, peristome pink; whorls 6, slowly and regularly increasing, above rather convex; sculpture, first three whorls nearly smooth, showing regular delicate oblique ribs under the lens, outer whorls with coarse irregular oblique striæ, between which are microscopic waved hair lines, confusedly malleated, sculpture coarser on the last whorl; apex obtuse, apical whorls minute, no definition of embryonic whorls; suture impressed, deepening as it proceeds; base rounded, umbilical region impressed, coarsely radiately striated; epidermis glossy, deciduous; aperture oblique, angularly lunate, peristome thickened and bent inwards, the base of the columella spread over almost all the umbilicus, margins not connected by a callus. Diam. maj. 60, min. 49, alt. 34 mm.

Type in Queensland Museum.

Habitat.—Fly River (Macgregor); three dead shells.

3.* NANINA CITRINA, Linné, 1759.

Illustrations.—Chem. Conch. Cab. IX. pl. 131, figs. 1170, 1172, 1173; Pfeiffer, Conch. Cab. 2nd ed. pl. 35, figs. 1, 2, 3; Voy. "Astrolable," Zool. II. pl. 11, figs. 1, 2, 3, 4; Voy. "Uranie et Physicienne," Zool. pl. 67, figs. 2, 3; Ostas. Zool. II. pl. 6,

* Species thus distinguished extend beyond the boundaries of British New Guinea.

figs. 1-12, pl. 7; Reeve, Conch. Icon. VII. pl. 89, fig. 482a, b, c, d; Tryon, Man. Conch. (2), II. pl. 20, figs. 88-95; &c., &c.

Descriptions.—Linné, Syst. Nat. ed. 10, p. 771; Mon. Hel. Viv. I. p. 53; Voy. "Astrolable," Zool. II. p. 140; Voy. "Uranie et Physicienne," Zool. p. 471; Voy. "Coquille," Zool. II. p. 306; Ostas. Zool. II., p. 193; Lamarck, An. s. Vert. VI. pt. 2, p. 77; Tryon, Man. Conch. (2), II. p. 72; &c., &c.

Anatomy.—Semper, Reis. Philipp. III. p. 63, pl. 3, fig. 13a, b, pl. 6, fig. 30; Ann. Mus. Gen. XIX. pl. 8, fig. 2.

Type in Linnean Society's Museum, London.

Habitat.—Douglas River (Bevan), Fly River (Froggatt), foot of Owen Stanley Range (Goldie).

4.* N. HUNSTEINI, E. A. Smith, 1887.

Illus^{n}.—Ann. Mag. Nat. Hist. (5), XIX. pl. 15, figs. 6.

Descr^{n}.—L.c. (5), XIX. 416.

[redacted]

5. N. FRAUDULENTA, E. A. Smith, 1887.

Descr^{n}.—Ann. Mag. Nat. Hist. (5), XIX. 417.

Type in British Museum.

Hab.—Foot of Astrolabe Range (Goldie *fide* Smith) ?

6. N. CAIRNI, E. A. Smith, 1887.

Illus^{n}.—Ann. Mag. Nat. Hist. (5), XIX. pl. 15, fig. 5.

Descr^{n}.—L.c. (5), XIX. 417.

Type in British Museum.

Hab.—Foot of Astrolabe and Owen Stanley Ranges (Goldie *fide* Smith).

7. N. EXILIS, Muller, 1774 (?)

Illus^{n}.—Ann. Mag. Nat. Hist. (5), XIX. pl. 15, fig. 13.

Descr^{n}.—L.c. (5), XIX. 418.

Specimens I gathered near Aipiana resemble Smith's figure.

8. N. DIVISA, Forbes, 1852.

Illus^{n}.—Voy. "Rattlesnake," II. pl. 2, figs 5 a-b; Reeve, Conch. Icon. VII. pl. 205, fig. 1450; Tryon, Man. Conch. (2), II. pl. 13, fig. 70.

Descr^{n}.—Mon. Hel. Viv. III. p. 77; Voy. "Rattlesnake," II. Append. p. 376; Tryon, Man. Conch. (2), II. 39.

Type in British Museum.

Hab.—Sudest Island, Louisiades (Forbes, Kowald and Belford).

var. *inclinata*, Pfeiffer, 1863.

Illus^{n}.—Ann. Mag. Nat. Hist. (6), IV. pl. 13, fig. 16.

Descr^{n}.—P.Z.S. 1863, p. 526; Mon. Hel. Viv. V. p. 129.

Type in British Museum.

Hab.—St. Aignan or Misima (Thomson, Kowald and Belford).

var. *rosseliana*, Smith, 1889.

Illus^{n}.—Ann. Mag. Nat. Hist. (6), IV. pl. 13, fig. 15.

Descr^{n}.—L.c. (6), IV. 200.

Type in British Museum.

Hab.—Rossel Island (Thomson).

var. *minor*, var.nov.

Resembling the type in outline but smaller and lighter in colour. Diam. maj. 22, min. 19, alt. 11 mm.

Type in Queensland Museum.

Hab.—Mita, Milne Bay (Hedley).

var. *woodlarkensis*, var.nov.

More globose than type, much inflated around the umbilicus. Diam. maj. 31, min. 27, alt. 17 mm.

11. Conulus starkei, Brazier, 1876.

(Plate ix., fig. 5.)

Descrⁿ.—P.L.S.N.S.W. (1), i. 103; Ann. Mus. Gen. xix. p. 98.

Type in Macleay Museum.

Hab.—Yule Island (Brazier); in scrub on the hills behind the village of Maiva, in scrub on Mission Hill, beach just above high tide mark Port Moresby, beach ditto Mita, Milne Bay (Hedley). Mr. Brazier's type specimen is here figured by kind permission of Mr. Masters.

The following extract from my note-book refers to a Mita specimen :—Animal translucent; when extended foot not reaching to posterior margin of shell, tail keeled and diagonally grooved, terminating in a mucous pore, surmounted by a small horn; foot margined with a pedal line; tentacles short, cylindrical, bases separate.

This species should be compared with such forms as *subrugosa*, Garrett, from Fiji.

12. C. maino, Brazier, 1876.

(Plate ix., fig. 6).

Descrⁿ.—P.L.S.N.S.W. (1), i. 101; Ann. Mus. Gen. xix. p. 97

Type in Macleay Museum.

Hab.—Yule Island (Brazier).

Figured from the type.

13. Microcystina sappho, Brazier, 1876.

(Plate ix., fig. 7.)

Descrⁿ.—P.L.S.N.S.W. (1), i. 100; Ann. Mus. Gen. xix. p. 95.

Type in Macleay Museum.

Hab.—Yule Island (Brazier); Maiva and Mission Hill, in company with *C. starkei* (Hedley).

Figured from a Maivan specimen.

14. M. CALCARATA, n.sp.

(Plate IX., fig. 8, and Pl. X., fig. 9.)

Shell small, subdiscoidal, perforate, thin, translucent; colour dark chestnut, apical whorls straw-coloured; whorls 4½, rounded, slowly increasing; sculpture, to the unassisted eye the surface is smooth and glossy, but the microscope shows extremely fine radiating waved hair lines; spire scarcely elevated, embryonic whorls 2, distinct; suture channelled, margined beneath by a heavy opaque callus; base flattened, umbilicus narrow triangular, circum-umbilical region funnel-shaped; aperture not descending, vertical, ovate lunate, peristome straight, thin, columellar margin thickened and produced into a callous spur overhanging the umbilicus, callus on body whorl thin and microscopically granulated. Diam. maj. 2½, min. 1½, alt. 1 mm.

Type in Queensland Museum.

Hab.—Associated with *C. starkei* and *P. pedicula* under sticks and stones, near the beach, 200 yards west of Mita village

The length of the largest spirit specimen, from muzzle to mucous pore, was 20 mm., the tail extending posteriorly half that distance from the visceral hump. General colour light yellow, upper surface of tail, mantle lobes, neck, and tentacles bluish-gray. Tail subkeeled, scarcely diminishing in height posteriorly, suddenly increasing at caudal extremity and terminating abruptly, bearing a well-developed mucous pore above the pedal groove; a dorsal central groove runs the length of the tail distributing oblique branches which reach the pedal groove. The mantle is divided into left and right triangular shell lobes and two neck lappets. From the lips a well-defined pedal line extends to the mucous pore, from the pulmonary orifice and from a corresponding position on the left side another groove runs to the lips.

The jaw is that of a typical *Helicarion*, smooth, lunate, with inferior median limb.

In the odontophore the rows of teeth curve slowly backwards from the rachidian, which has a slender ovate median cusp and two small accessory cusps, the laterals develop only the distal cusp, and their main cusp is longer and broader than that of the rachidian; after being repeated for twelve rows this type is succeeded by 20 small unicuspidate marginals.

This species, the first of its genus recorded from New Guinea, is dedicated to C. W. de Vis, Esq., M.A., Director of the Queensland Museum, as a slight token of the author's regard and gratitude for numberless kind actions.

16. H. MUSGRAVEI, n.sp.

(Plate x., fig. 14.)

Shell globose, thin, brittle, transparent; pale yellow; whorls 3½, rounded; suture impressed, margined, sculpture minute incremental striæ; base imperforate, impressed in the centre, swollen around it; aperture oblique ovate lunate, lip thin, simple, margins connected by a slight callus, columellar margin reflected. Diam. maj. 6, min. 5, alt. 4 mm.

T y p e in Queensland Museum.

Hab.—Doura (Hedley).

Named after the Hon. A. Musgrave, of British New Guinea.

17. †Thalassia annula, Brazier, 1876.

(Plate x., fig. 10.)

Descrn.—P.L.S.N.S.W. (1), I. 100; Ann. Mus. Gen, XIX. p. 94.

Type in Macleay Museum.

Hab.—Village of Mowatta, mouth of Katow River (Brazier).

Figured from type.

Doubtful,—*T. rustica*, Pfr., supposed by Mr. Petterd to exist near Port Moresby (*vide* Journ. of Conch. I. p. 396; Ann. Mus. Gen. XXIV. p. 125 bis.).

18. †Trochomorpha planorbis, Lesson, 1830.

Illusn. Voy. "Coquille," Moll. pl. 13, figs. 1, 4', 4"; Pfeiffer,

20. T. NIGRANS, E. A. Smith, 1889.

Illus^n.—Ann. Mag. Nat. Hist. (6), IV. pl. 13, figs. 9, 10, 11.

Descr^n.—L.c. p. 200.

Type in British Museum.

Hab.—Rossel Island (Thomson, Belford and Kowald).

var. *cornea*, var.nov.

Smaller than type, horn-coloured. Diam. maj. 16, min. 14, alt. 6 mm.

Type in Queensland Museum.

Hab.—Sudest Island (Kowald and Belford); one specimen.

21. OCHTHEPHILA ALBERTISI, Brazier, 1876.

(Plate x., fig. 11.)

Descr^n.—P.L.S.N.S.W. (1), I. 104; Ann. Mus. Gen. XIX. p. 183.

Type in Macleay Museum.

Hab.—Yule Island (Brazier).

Figured from the type. The generic position of this species is doubtful.

22. CHAROPA TEXTA, n.sp.

(Plate x., fig. 12.)

Shell depressed turbinate, thin, perforate, glistening; colour reddish-corneous; whorls 4½, rounded, flattened beneath the suture; sculpture strong sinuate oblique radiating ribs, of which the last whorl possesses about 60, in each interstice and parallel to the ribs are 4 or 5 fine raised hair lines, decussating these secondary costæ and of the same calibre are raised spiral lines, which are most prominent on the spire and base; epidermis possessing a silky sheen; suture deeply impressed; apex not prominent, embryonic whorls 1½, shining, nearly smooth, but faintly repeating the adult sculpture; umbilicus narrow, deep, spiral; base rounded; aperture oblique, roundly lunate, peristome

straight, sharp, columellar margin reflected. Diam. maj. 6, min. 5, alt. 4 mm.

Type in Queensland Museum.

Hab.—Mission Hill, Upper St. Joseph River (Hedley); two living specimens occurred to me under fallen timber in dense jungle.

23. RHYTIDA GLOBOSA, Hedley, 1890.

(Plate x., figs. 15-16.)

Descrn.—Annual Report of British New Guinea, 1888-89, p. 65.

Shell depressed-globose, thin, translucent, perforate, very glossy; whorls 4½, the earlier flattened, the later rounded, rather rapidly increasing, the last a little expanded, not descending at the aperture; colour reddish-chestnut above, lighter beneath, first three whorls bleached nearly white; sculpture almost effaced on the body whorl, where nearly obsolete spiral impressed lines cross

fabrefacta, Pease. I cannot venture to describe the species from my single dead and bleached specimen, but can only record the existence in New Guinea of a group hitherto regarded as peculiar to the Eastern Pacific.

24. Cristigibba rhodomphala, Tapparone-Canefri, 1883.

Illus^{n}.—Ann. Mus. Gen. xix. pl. 4, figs. 12, 13.

Descr^{n}.—L.c. xix. p. 176.

Type in Genoa Museum.

var. *alpha*.

Hab.—Fly River (D'Albertis, Froggatt); Douglas River (Bevan); Mission Hill (Hedley).

25. C. plagiocheila, Tapparone-Canefri, 1883.

Illus^{n}.—Ann. Mus. Gen. xix. pl. 5, figs. 4, 5, 6, 7.

Descr^{n}.—L.c. xix. p. 174.

Anat.—L.c. xix. pl. 7, fig. 6.

Type in Genoa Museum.

Hab.—Fly and Katow Rivers (D'Albertis).

26. C. dominula, Tapparone-Canefri, 1883.

Illus^{n}.—Ann. Mus. Gen. xix. pl. 4, figs. 8, 9, 10, 11.

Descr^{n}.—L.c. xix. p. 178.

Anat.—L.c. xix. pl. 7, fig. 4, pl. 9, figs. 5, 14.

Type in Genoa Museum.

vars. *alpha, beta, delta*.

Hab.—Fly and Katow Rivers (D'Albertis); Douglas River (Bevan).

27. C. deaniana, Ford, 1890.

Descr^{n}.—Proc. Acad. Sci. Phil. 1890, p. 188.

Type in Phil. Acad. Museum.

Hab.—British New Guinea (Denton).

28. C. MACGREGORI, n.sp.

(Plate x., figs. 17-19.)

Shell umbilicated, discoidal, thin, translucent; colour reddish-brown above, lighter beneath, peristome bright lilac, interior of shell subnacreous, iridescent, gleaming bluish-white; whorls 4½, rounded, the earlier gradually the last rapidly increasing, last descending considerably and gradually at the aperture and furnished with the gibbosity characteristic of the genus; sculpture oblique flat-topped costæ whose shallow interstices contain two or three fine radiating striæ, both costæ and striæ are crossed by minute spiral grooves; apical whorls sunken, smooth; suture deeply impressed; aperture diagonal, lunate, peristome widely expanded above, reflected below, margins approaching, connected by a thin transparent callus, columellar margin expanded over a quarter of the umbilicus; the latter narrow, deep, showing every revolution of the spire, margin abruptly rounded. Diam. maj. 28, min. 21, alt. 12 mm.

continuous peristome, on which feature Ford bases his distinction. Before his death in New Guinea, Professor Denton visited Northern Queensland, where no doubt he collected Ford's specimens.

29. CHLORITIS DINODEOMORPHA, Tapparone-Canefri, 1883.

Illus^n.—Ann. Mus. Gen. XIX. pl. 4, figs. 4, 5, 6, 7.

Descr^n.—L.c. XIX. p. 168.

Anat.—L.c. XIX. pl. 7, fig. 5, pl. 9, figs. 2, 15.

Type in Genoa Museum.

Hab.—Fly River (D'Albertis, Froggatt); Mission Hill, St. Joseph River (Hedley).

30. C. LEEI, Cox, 1873.

Illus^n.—P.Z.S. 1873, pl. 48, figs. 5, 5a.

Descr^n.—L.c. 1873, p. 565; Mon. Hel. Viv. VII. p. 395; Ann. Mag. Nat. Hist. (6), IV. 201.

Type in Australian Museum.

Hab.—St. Aignan (Thomson *fide* Smith, Kowald and Belford).

var. *woodlarkensis*, var.nov.

Smaller than type, lip dark purple, umbilicus nearly hidden by the reflection of the columella. Diam. maj. 25, min. 20, alt. 18 mm.

Hab.—Woodlark Island (Kowald and Belford).

var. *sudestensis*, var.nov.

Larger and more globose than type, lighter in colour, and umbilicus less overhung by the reflection of the columella. Diam. maj. 34, min. 25, alt. 26 mm.

Hab.—Sudest Island (Kowald and Belford).

var. *papuensis*, var.nov.

More elevated than type. Diam. maj. 33, min. 25, alt. 26 mm.

Hab.—Mita, Milne Bay, and Mr. Kissack's selection near Samarai (Hedley).

How far these insular forms may be permanent my material is too scanty to satisfactorily decide.

31. C. SUBCORPULENTUS, E. A. Smith, 1889.

Illus^n.—Ann. Mag. Nat. Hist. (6), IV. pl. 13, fig. 14.

Descr^n.—L.c. p. 201.

Type in British Museum.

Hab.—Rossel Island (Thomson).

In the jungle near Doura I found living with *H. musgravei*, a new species of *Chloritis* allied to the Queensland *porteri*. My specimens of it were accidentally crushed before reaching Australia.*

32. †HADRA REHSEI, von Martens, 1883.

Synonym—*gerrardi*, Smith, 1883.

Illus^n.—Ann. Mag. Nat. Hist. (5), XIX. pl. 15, fig. 14.

Descr^n.—Jahrb. Malak. Gesell. 1883, p. 83; Ann. Mag. Nat. Hist. (5), XI. 192; l.c. (5), XIX. 418.

Type (?)

Type in Coll. Hobson.

Hab.—Seven miles inland from Hall Sound (Hixon *fide* Brazier).

35. H. BROADBENTI, Brazier, 1877.

Illus^n.—Ann. Mus. Gen. XIX. pl. 5, fig. 21; Tryon, Man. (2) VI. pl. 25, fig. 100.

Descr^n.—P.L.S.N.S.W. (1), II. 25; Ann. Mus. Gen. XIX. p. 188; Tryon, Man. (2) VI. p. 176.

Type in Queensland Museum.

Hab.—Not Dentrecasteaux Islands (Goldie *fide* Smith), but Laloki River, near Port Moresby (Broadbent); village of Najabui (D'Albertis); St. Joseph River (Hedley).

Mr. Brazier has kindly furnished me with the following description:—

36. "HELIX BEVANI, Brazier, n.sp.

(Plate XI., figs. 22-23.)

"Shell umbilicate, depressed, sharply carinated at the periphery, thin, obliquely striated, reddish-brown with a dark nearly black narrow line at the centre, epidermis yellowish-brown; spire slightly elevated; apex dark pink; suture moderately impressed; whorls 4½, very slightly convex, last largest in front; umbilicus narrow, shallow; base flattened, striæ finer than upper surface; aperture hatchet-shaped; peristome black, slightly expanded and reflected, right margin at the upper part thin; columellar margin broadly expanded and reflected over the umbilicus. Diam. maj. 45, min. 35, alt. 18 mm.; height of aperture 12, breadth 21 mm.

"Type in Australian Museum.

"Hab.—Douglas River, British New Guinea (Bevan).

"This fine species is allied to *Helix Goldei*, Braz.; a single dead specimen in a good state of preservation was found by Mr. Theodore F. Bevan, F.R.G.S., during his exploration of British New Guinea in 1887."

37. Geotrochus oxystoma, E. A. Smith, 1883.

(Plate x., fig. 20, and Pl. xi., fig. 21.)

Syn.—*goldiei*, Brazier.

Descrn.—Ann. Mag. Nat. Hist. (5), xi. 191; P.L.S.N.S.W. (1), ix. 804.

Type in British Museum.

Hab.—Not Dentrecasteaux Islands (Goldie *fide* Smith), but foot of Astrolabe Range (Goldie) and Doura, Galley Reach (Hedley).

By adopting *Geotrochus* as a generic title the necessity is obviated of discarding Smith's name, since *oxystoma* is not preoccupied in *Geotrochus*, though, as Brazier points out, it is in *Helix*. The figures which illustrate, though they hardly adorn, p. 173 of Stone's "Ten Months in New Guinea," are intended, I believe, to represent this species.

38. G. elisus, n.sp.

connected by a transparent callus. Diam. maj. 29, min. 24, alt. 10 mm.

The Macleay Museum contains four dead shells of this species, which appear to resemble *G. pelechystoma*, Tapp.-Can., purchased from Mr. Goldie, who collected them in British New Guinea.

39. G. TAYLORIANUS, Adams and Reeve, 1851.

Syn.—*yulensis*, Brazier, 1876; *strabo*, Brazier, 1876; *katauensis*, Tapparone-Canefri, 1883; *roseolabiatus*, Smith, 1887.

Illus$^{n.}$—Voy. "Samarang," Zool. pl. 15; 2a, 2b; Ann. Mag. Nat. Hist. (5), XIX. pl. 15, figs. 1, 1a, 2; Reeve, Conch. Icon. VII. pl. 96, No. 524, a, b; P.L.S.N.S.W. (2), II. pl. 21, figs. 5, 6; Ann. Mus. Gen. XIX. pl. 3, figs. 1, 2, 3.

Descr$^{n.}$—"Samarang", Zool. p. 59; P.L.S.N.S.W. (1), I. 106; Ann. Mus. Gen. XIX. p. 123, 125; Journ. of Conch. VI. p. 76; Ann. Mag. Nat. Hist. (5), XIX. 421, &c.

Anat.—Ann. Mus. Gen. XIX. pl. 6, figs. 1, 3; pl. 8, fig. 11.

Type in British Museum.

Hab.—Yule Island and Katow River (Brazier and D'Albertis); St. Joseph River (Hedley); Fly River (Froggatt); Maclachie Point, Krema district, foot of the Albert Range of mountains (Goldie).

An examination of a large series of shells in the possession of Mr. Brazier induces me to consider *G. taylorianus* as a most variable form. The following prominent varieties are linked each to each by intermediate graduations:—

(a) *yulensis*; smaller than type, mottled with oblique irregular black dashes, which by transmitted light appear as translucent spaces. (Yule Island, J.B.)

(b) *katauensis*; encircled by black spiral bands. (Maclachie Point, Goldie.)

(c) *strabo*; a monochrome form with no clear mottled spaces; approaches nearest to *taylorianus*. (Maclachie Point, Goldie.)

(d) *rossolabiatus* ; with a black band at the suture and the periphery. (Maclachie Point, Goldie.)

This form is confined to western British New Guinea and the eastern localities quoted by Smith; South Cape and Dentrecasteaux Islands are to be discredited.

The history of the original specimen appears to have been lost. Since, before *G. taylorianus* was described, H.M.S. "Fly" was the only European vessel that visited the territory inhabited by this species, I conjecture that the type was procured in May, 1845, by Jukes or MacGillivray during her voyage to this coast.

40. G. TAPPARONEI, E. A. Smith, 1883.

(Plate XI., fig. 26.)

Syn.—*hunsteini*, Brazier, MSS.

Descrn.—Ann. Mag. Nat. Hist. (5), XI. 190; P.L.S.N.S.W. (1), IX. 805.

Type in British Museum.

Descr^{n}.—Ann. Mag. Nat. Hist. (5), XIX. 420; l.c. (5), XI. 191.

Type in British Museum.

Hab.—Foot of Astrolabe and Owen Stanley Range (Goldie).

42. G. DIOMEDES, Brazier, 1878.

Illus^{n}.—Ann. Mus. Gen. XIX. pl. 3, fig. 12.

Descr^{n}.—P.L.S.N.S.W. (1), II. 121; Ann. Mus. Gen. XIX. 122.

Type in Australian Museum.

Hab.—Not Brumer Island (Brazier), but Coutances Island * (Broadbent *fide* Brazier); and therefore not a member of the Louisiade fauna, as stated in Ann. Mag. Nat. Hist. (6), VII. 135.

A dead shell, too worn to be described, but evidently new, and related to the two last species, was collected by Sir W. Macgregor during his expedition to the Fly River in 1890.

43. †G. BRUMERIENSIS, Forbes, 1852.

(Plate XI., fig. 29.)

Illus^{n}.—Voy. "Rattlesnake," Appen. pl. 2, fig. 1, a, b; Reeve, Conch. Icon. VII. pl. 205, fig. 1448; Tryon, Man. (2), VI. pl. 12, figs. 41, 42, 43.

Descr^{n}.—Voy. "Rattlesnake," II. p. 375; Mon. Hel. Viv. III. p. 189; Ann. Mag. Nat. Hist. (5), XIX. 419.

Type in British Museum.

Hab.—Brumer Island (Forbes); Millport Harbour, Amazon Bay (Goldie *fide* Brazier); Bently and Milne Bays, South Cape, Samarai, Loggia and Basilaki Islands (Hedley).

var. *albolabris*, var. nov.

Lip entirely white.

Type in Queensland Museum.

Hab.—Mita, Milne Bay.

* Coutances Island is situated in 146° 10′ E. long., 10° 15′ S. lat.

G. brumeriensis inhabits heavy-limbed trees, preferring those with whitish bark, like *Hibiscus tiliaceus* and *Artocarpus incisus*. In its favourite perch, on the under side of the larger boughs, its resemblance to a knot renders it difficult to detect. Animal 60 mm. in total length. Shell placed posteriorly. Tentacles slender, tapering, 15 mm. long when fully expanded, bases four mm. apart. Tail flat, pointed. Tentacles jet black; head and neck ornamented by narrow white longitudinal tubercles on a black ground; foot everywhere bordered above by a narrow band of intense black, above which is an ill-defined zone of greyish white merging above into black; sole of foot black at edges, whitish within; mantle yellowish-white. Mucus unusually dense like that of the arboreal Limaces. Egg small, soft, white, oblong.

44. G. LOUISIADENSIS, Forbes, 1852.

Illus^n.—Voy. "Rattlesnake," Appen. pl. 1, figs. 8a, b; Reeve, Conch. Icon. VII. pl. 205, fig. 1449.

Type in British Museum.

Hab.—Not South Cape Island (Rolls), but Seymour Bay, Fergusson Island (Hedley). As Rolls and Goldie landed in Seymour Bay, I have no doubt that they collected the type exactly where I found the species several years afterwards. I make the above correction with the more confidence since I have searched South Cape in vain for it. It is interesting to note that both *G. rollsianus* and *P. braziera*, which I also gathered at Seymour Bay, find their allies among the distant Louisiades and not with the molluscs of the nearer mainland.

Animal slender; colour entirely white in one specimen, bluish-white in another; tentacles long, slender, tapering, bases wide apart. Observed crawling upon the trunks of trees.

47. G. ALBOCARINATUS, E. A. Smith, 1887.

Illus^{n}.—Ann. Mag. Nat. Hist. (5), XIX. pl. 15, fig. 12.

Descr^{n}.—L.c. p. 422; l.c. (6) VII. 137.

Type in British Museum.

Hab.—Woodlark Island (Dr. Rabe *fide* Brazier); another recorded but probably erroneous locality is South Cape Island (Goldie).

48. G. THOMSONI, E. A. Smith, 1889.

Illus^{n}.—Ann. Mag. Nat. Hist. (6), IV. pl. 13, figs. 12, 13.

Descr^{n}.—L.c. (6), IV. 202.

Type in British Museum.

var. a.

Hab.—St. Aignan, Louisiades (Thomson, Kowald and Belford).

49. G. WOODLARKIANUS, Souverbie, 1863.

Illus^{n}.—Journ. de Conch. XI. pl. 5, fig. 2.

Descr^{n}.—L.c. pp. 76 and 172; Mon. Hel. Viv. v. p. 271; Ann. Mag. Nat. Hist. (6), VII. 137.

Type in Bordeaux Museum.

Hab.—Woodlark Island (French Missionaries, Kowald and Belford, Dr. Rabe *fide* Brazier); Normanby Island (Dr. Rabe), the latter a doubtful locality.

50. G. TROBRIANDENSIS, n.sp.

(Plate XI., fig. 28.)

Shell imperforate, trochiform, thin, translucent, keeled at the periphery, keel becoming obsolete latterly; colour white, encircled by seven chestnut bands, four above and three below the periphery, these bands are very variable, each or all may disappear or coalesce, when absent a translucent band marks the site, the bands fade away on the penultimate whorl, occasionally as in allied species opaque alternate with translucent dashes radiating from the suture, peristome from the insertion of the right margin to the centre of the base an intense black; whorls 4½, convex, last contracted; sculpture, obliquely finely striated and finely granulated; apex obtuse, embryonic whorls distinct, 1½; suture impressed;

Hab.—Katow River (D'Albertis); Fly River (D'Albertis, Froggatt, Macgregor).

var. *cingulatus*, var.nov.

Yellowish-white encircled by a single brown peripheral band margined beneath by an opaque white line.

Type in Queensland Museum.

Hab.—Village of Aipiana, St. Joseph River (Hedley).

52. G. TOMASINELLIANUS, Tapparone-Canefri, 1883.

Illus[n].—Ann. Mus. Gen. XIX. pl. 4, fig. 1, pl. 5, fig. 1.

Descr[n].—L.c. p. 148.

Anat.—L.c. p. 7, fig. 3, pl. 8, figs. 6, 12.

Type in Genoa Museum.

var. *alpha*.

Hab.—Fly River (D'Albertis, Froggatt); 400 miles up the Fly (Macgregor); Katow River (D'Albertis).

var. *azonatus*, var.nov.

Bandless, entirely yellow.

Type in Australian Museum.

Hab.—Douglas River (Bevan).

53. G. RIDIBUNDUS, Tapparone-Canefri, 1883.

Illus[n].—Ann. Mus. Gen. XIX. pl. 3, figs. 10, 11.

Descr[n].—L.c. p. 142.

Anat.—L.c. pl. 6, fig. 5, pl. 8, fig. 17.

Type in Genoa Museum.

Hab.—Fly River (D'Albertis).

54. G. MEDITATUS, Tapparone-Canefri, 1883.

Illus[n].—Ann. Mus. Gen. XIX. pl. 3, fig. 15.

Descr[n].—L.c. p. 144.

Anat.—L.c. pl. 6, fig. 6.

Type in Genoa Museum.

Hab.—Katow River (D'Albertis).

55. G. GESTROI, Tapparone-Canefri, 1883.

Illus^{n}.—Ann. Mus. Gen. XIX. pl. 4, fig. 3, pl. 5, fig. 3.

Descr^{n}.—L.c. p. 150.

Anat.—L.c. pl. 7, fig. 2, pl. 8, figs. 5, 14.

Type in Genoa Museum.

var. *alpha*.

Hab.—Fly River (D'Albertis).

56. G. SICULUS, Brazier, 1876.

Descr^{n}.—P.L.S.N.S.W. (1), I. 106; Ann. Mus. Gen. XIX. p. 153.

Type in Macleay Museum.

Hab.—Katow River (Brazier).

59. G. GURGUSTI, Cox, 1880.

Illusn.—P.L.S.N.S.W. (1), IV. pl. 16, fig. 1 ; l.c. (2), II. pl. 21, figs. 3, 4.

Descrn.—l.c. (1), IV. 114.

Type in Australian Museum.

Hab.—Rossel Island, Louisiades (Hovell).

60. G. CHAPMANI, Cox, 1880.

Syn.—*coraliolabris*, Smith, 1887.

Illusn.—P.L.S.N.S.W. (1), IV. pl. 16, fig. 2 ; l.c. (2), II. pl. 21, figs. 10, 11 ; Ann. Mag. Nat. Hist. (5), XIX., pl. 15, fig. 4 ; Tryon, Man. (2), VI. pl. 17, fig. 13.

Descrn.—P.L.S.N.S.W. (1), IV. 115 ; Ann. Mag. Nat. Hist. (5), XI. 419 ; l.c. (6), IV. 201.

Type in Australian Museum.

Hab.—Rossel Island, Louisiades (Hovell, Thomson).

61. G. CANOVARI, Tapparone-Canefri, 1883.

Illusn.—Ann. Mus. Gen. XIX. pl. 3, fig. 6.

Descrn.—L.c. XIX. p. 131.

Type in Genoa Museum.

Hab.—Fly River (D'Albertis) ; Observation Point, Fly River (Froggatt).

62. G. BOYERI, Fischer and Bernardi, 1857.

Illusn.—Journ. de Conch. V. pl. 9, figs. 8, 9.

Descrn.—L.c. V. p. 297 ; Ann. Mag. Nat. Hist. (6), VII. 137 ; Mon. Hel. Viv. IV. p. 201.

Type in collection of Journ. de Conch.

Hab.—Not Admiralty Island (F. & B.), nor Louisiades (Angas *fide* Pfeiffer), but Woodlark Island (Dr. Rabe *fide* Brazier, Kowald and Belford).

63. †G. DAMPIERI, Angas, 1869.

Illus^{n}.—P.Z.S. 1869, pl. 2, figs. 6; 1885, pl. 36, fig. 5.

Descr^{n}.—L.c. 1869, p. 47; Mon. Hel. Viv. VII. p. 310.

Type (?).

Hab.—Louisiade Islands (Angas)?.

No definite locality in the Louisiades is known for this shell, and since a variety is recorded from the Solomons by Smith (P.Z.S. 1885, p. 592), it is most probable that the type was derived from thence.

Recorded from the province in error.

G. (?) CONIFORMIS, Férusac.

Jahrb. deutsche mal. Gesell. 1880, p. 15.
Louisiade Archipelago (Kobelt, l.c.).

G. HORDERI, Sowerby.

[redacted]

extends over the axis and curves up to the insertion of the right margin. Alt. 55, breadth 38 mm.

The Macleay Museum possesses several examples of this species, purchased from Mr. Goldie, who collected them in British New Guinea. Considerable difference in size and form exists between these specimens, none of which are in a good state of preservation. One old and worn shell exhibits on the inner side of the columella a tubercle 10 mm. long and 2 mm. wide. Whether this be a distinct species, the adult form, or merely a variety of the species described above, requires further material to decide.

65. CALYCIA ISSELIANA, Tapparone-Canefri, 1883.

Illus^n.—Ann. Mus. Gen. xix. p. 101, figs. b, c.

Descr^n.—L.c.

Type in Genoa Museum.

Hab.—Katow River (D'Albertis).

The systematic position of this mollusc is uncertain.

66. †BULIMUS MACLEAYI, Brazier, 1876.

Syn.—*beddomei*, Brazier, MSS.

Illus^n.—Ann. Mus. Gen. xix. pl. 2, figs. 16, 17.

Descr^n.—P.L.S.N.S.W. (1), I. 108; l.c. (1), IV. 395; Ann. Mus. Gen. xix. p. 104; Trans. Roy. Soc. S. Australia, V. p. 50.

Type in Macleay Museum.

Hab.—Yule Island (Brazier, D'Albertis).

This species ranges south to North Queensland and west to Port Darwin.

67. PARTULA SIMILARIS, Hartman, 1886.

Illus^n.—Proc. Acad. N.S. Phil. 1886, pl. 2, fig. 1.

Descr^n.—L.c. p. 30.

Type.—(?)

Hab.—Woodlark Island (Brazier).

68. P. WOODLARKIANA, Hartman, 1886.

Illus^{n}.—*Proc. Acad. N.S. Phil.* 1886, pl. 2, fig. 8.

Descr^{n}.—L.c. p. 33.

Type—(?).

Hab.—Woodlark Island (Brazier).

After examining the figures and descriptions of these two species, I am unable to grasp any specific distinction between them. Specimens collected at the Woodlarks by Messrs. Kowald and Belford during the cruise of the "Merrie England" in 1890 are referable to both or either forms.

69. P. OCCIDENTALIS, n.sp.

(Plate XII., fig. 31.)

Shell dextral, ovate elongate, thin and translucent; colour (?); whorls 5, rounded, last a little flattened below the suture; sculpture everywhere encircled by close sharply impressed spiral lines, which are decussated by oblique irregular lines of growth, at the [redacted]

Mousson, 1865; *panayensis*, Pfeiffer, 1846; *diaphana*, Gassies, 1859; *souverbiana*, Gassies, 1863; *artensis*, Gassies, 1866; *novemgyruta*, Mousson, 1870; *gyrata*, Mousson, 1885.

Illusⁿ.—Conch. Icon. pl. 68, sp 481, pl. 14, No. 76; Mon. Austr. L. Shells, pl. 13, fig. 9; Gould, Expl. Exped. Shells, fig. 87 Phil. Is. Land Moll. III. pl. 8, figs. 14, 15; Martens, Ostas. Zool. II. pl. 22, fig. 8; Faune Nouv. Caled. pt. 1, pl. 2, fig. 5; Journ. de Conch. 1863, pl. XIV. fig. 6; &c., &c.

Descrⁿ.—Wiegm. Arch. I. 352; Moll. Cub. I. 177; P.Z.S. 1846, p. 30, 1887, p. 185; Mon. Hel. Viv. II. p. 158; Mon. Austr. L. Shells, p. 69; Proc. Bost. Soc. Nat. Hist. II. p. 35, 191; Journ. de Conch. 1859, p. 370; Faune Nouv. Caled. pt. 1, p. 52; &c., &c.

Anat.—Reis. Phil. Land Moll. III. pl. XI. figs. 17, 21.

Type in British Museum.

Hab.—St. Joseph River, Port Moresby, Samarai, and Milne Bay (Hedley).

It is remarkable that this common and ubiquitous mollusc has not been previously recorded from the New Guinea mainland.

71. TORNATELLINA TERRESTRIS, Brazier, 1876.

Descrⁿ.—P.L.S.N.S.W. (1), I. 109; Ann. Mus. Gen. XIX. p. 102.

Type in Macleay Museum.

Hab.—Yule Island (Brazier).

72. †PUPA PEDICULA, Shuttleworth, 1852.

Syn.—*artensis*, Montrouzier, 1859; *nitens*, Pease, 1860; *nacca*, Gould, 1862; *hyalina*, Zelebor, 1868; *macdonnelli*, Brazier, 1875; *recondita*, Tapparone-Canefri, 1883; *samoensis*, Schmeltz, MSS.

Illusⁿ.—Journ. de Conch. VII. pl. 8, fig. 4; Faune Nouv. Caled. pt. 1, pl. 6, fig. 21; P.Z.S. 1874, pl. 83, figs. 22, 23; Ann. Mus. Gen. XIX. pl. 2, figs. 3, 4.

Descr^{n}.—Bern. Mittheil. 1852, p. 296; Mon. Hel. Viv. III. p. 557, VI. pp. 329, 330, 335; Journ. de Conch. VII. p. 288; Faune Nouv. Caled. pt. 1, p. 54; P.Z.S. 1860, p. 439, 1874, p. 669, 1887, p. 188; Proc. Boston Soc. Nat. Hist. VIII. p. 280; Otia Conch. p. 237; Quart. Journ. of Conch. 1877, p. 5; Ann. Mus. Gen. XIX. p. 106.

Type—(?).

Hab.—Mita, Milne Bay, Samarai and Loggia Islands (Hedley).

73. †SUCCINEA SIMPLEX, Pfeiffer, 1854.

(Plate XII., fig. 32.)

Descr^{n}.—P.Z.S. 1854, p. 123, 1885, p. 595; Mon. Hel. Viv. IV. p. 813.

Type in British Museum.

A species of *Succinea* occurs in abundance upon the stems of taro leaves in the hill gardens above Mita village, Milne Bay, specimens of which answer fairly well to the description Pfeiffer gives

Illus^n.—Mon. Austr. L. Shells, pl. 15, figs. 9, 9a, 9b; Journ. de Conch. 1862, pl. 9, fig. 10; Faune Nouv. Caled. pl. 8, fig. 2.

Descr^n—P.Z.S. 1856, p. 336; 1887, 300; Mon. Auric. I. pp. 186, 188; Mon. Austr. L. Shells, p. 92; Journ. de Conch. 1862, p. 243; Faune Nouv. Caled. p. 73; &c., &c.

Type in British Museum.

Hab.—Port Moresby (Hedley).

The Truncatellæ are characteristic of an assemblage of forms which may be termed the land littoral fauna, other members being *Stenogyra tuckeri*, *Pupa pedicula*, *Pythia scarabæus*, and perhaps, *Conulus starkei*, and *C. russelli*. This littoral fauna always inhabits, but is not invariably confined to, the neighbourhood of the sea beaches. The smallest islands which possess any life at all are usually stocked by these forms, which appear to range from Ceylon in the west to the Sandwich Islands in the east, and to be limited north and south by the tropics. Within these bounds they are associated with many widely different faunæ.

76. Omphalotropis braziERI, n.sp.

(Plate XII., fig. 33.)

Shell acutely ovate; colour corneous; whorls 5, convex, gradually increasing; sculpture, regular oblique striæ, last whorl encircled at the periphery by a strong keel; suture impressed; spire conical, a quarter of total length, apex acute; base flattened; umbilicus small, angled at the margin; aperture oblique, subcircular, angled above, peristome double, callus on body whorl thin. Operculum not observed. Length 5, breadth 3 mm.

Type in Queensland Museum.

Hab.—South shore of Milne Bay and Basilaki Island (Hedley); one example collected at each locality.

77. O. protracta, n.sp.

(Plate XII., fig. 34.)

Shell elevated conical, thin, turreted, glossy; colour dark corneous; whorls 6, gradually increasing, rounded, rather flattened

beneath the suture, last angled at the periphery; sculpture faint oblique striæ; suture impressed; spire produced, one-third of total length; base rounded; umbilicus ample, funnel-shaped, angled at the margin; aperture vertical, subcircular, angled above, peristome slightly thickened and scarcely reflected, callus on the body whorl thin. Operculum not observed. Length 3½, breadth 2 mm.

Type in Queensland Museum.

Hab.—Mission Hill, Upper St. Joseph River (Hedley); two examples under fallen timber in dense jungle.

78. Bellardiella minor, n.sp.

(Plate xii., fig. 35.)

Shell imperforate, oblong; colour ?; whorls 6, penultimate and antepenultimate bulging above the suture, last rather flattened on the periphery and more so on the base; spire inclined to the right, less than half of total length; apex acute, first two whorls devoid of sculpture appearing embryonic; sculpture, close oblique, sharp,

[redacted]

Type in British Museum.

Hab.—Rossel Island, Louisiades (Thomson, Kowald and Belford).

The Louisiade Pupinellæ appear to fall into three natural groups: (a) comprising *P. macgregori* and *P. minor*, in which the lateral canal is produced into a tube around the umbilical region; (b) containing *P. grandis*, *P. angasi*, *P. smithi*, *P. moulinsiana*, and *P. rosseliana*, in which the canal merely notches the columellar margin, the five in the order named being a graduated series whose notch is completely cut, half cut, and scarcely indented; they form an easy transition to (c) *P. brazieræ*, in which the notch is absent.

80. P. MINOR, E. A. Smith, 1889.

Illusn.—Ann. Mag. Nat. Hist. (6), IV. pl. 13, figs. 7, 8.

Descrn.—L.c. (6), IV. 205.

Type in British Museum.

Hab.—Rossel Island (Thomson, Kowald and Belford).

The single specimen, the second known to science, collected by the latter is in a good state of preservation. The colour is a dark red; the sculpture differs remarkably from that of its allies, their coarse malleations being entirely absent, instead are developed close, raised, oblique, sinuate hair lines. The lip and callus are, under the lens, delicately granulated.

81. P. GRANDIS, Forbes, 1852.

Syn.—*forbesi*, Pfeiffer, 1852.

Illusn.—Voy. "Rattlesnake," Append. pl. 2, figs. 10, a, b, c, d; Pfeiffer, Conch. Cab. ed. 2, pl. 31, figs. 19, 20; Conch. Icon. Pupinidæ, fig. 4.

Descrn.—Voy. "Rattlesnake," II. p. 380; Mon. Pneu. Viv. I. p. 140.

Type in British Museum.

Hab.—Sudest Island (Forbes, Kowald and Belford).

82. P. ANGASI, Brazier, 1875.

Syn.—*louisiadensis*, Smith, 1889.

Illus^{n}.—Ann. Mag. Nat. Hist. (6), IV. pl. 13, figs. 3, 4.

Descr^{n}.—P.L.S.N.S.W. (1), I. 5; Ann. Mag. Nat. Hist. (6), IV. 204, and (6), VII. 135.

Type in British Museum.

Hab.—Rossel Island (Thomson).

83. P. SMITHI, Brazier, 1891.

Syn.—*angasi*, H. Adams, 1875; *grandis* var. *minor*, Cox, 1873.

Illus^{n}.—P.Z.S. 1875, pl. 45, figs. 2, 2a.

Descr^{n}.—Ann. Mag. Nat. Hist. (6), VII. 136; P.Z.S. 1873, p. 567; l.c. 1875, p. 389; Mon. Pneu. Viv. suppl. 3, p. 412.

Type in British Museum.

Hab.—Louisiade Archipelago (Adams, &c.)

Type in collection of the Journ. de Conch.

Hab.—Woodlark Island (Montrouzier).

85. P. ROSSELIANA, E. A. Smith, 1889.

Illus^{n}.—Ann Mag. Nat. Hist. (6), IV. pl. 13, figs. 5, 6, 6a.

Descr^{n}.—L.c. (6), IV. 205.

Type in British Museum.

Hab.—Rossel Island (Thomson, Kowald and Belford).

86. P. BRAZIERÆ, E. A. Smith, 1887.

Syn.—*typica*, Brazier, MSS.

Illus^{n}.—Ann. Mag. Nat. Hist. (5), XIX. pl. 15, fig. 15.

Descr^{n}.—L.c. (5), XIX. 424, and (6), VII. 136.

Type in British Museum.

Hab.—Seymour Bay, Fergusson Island (Goldie, Hedley); Cape Pierson, Normanby Island (Dr. Rabe *fide* Brazier).

Found alive on the ground, under logs of wood.

var. *aignanensis*, var.nov.

Larger and more widely umbilicated than the type. Length 28 mm.

Type in Queensland Museum.

Hab.—St. Aignan, Louisiades (Kowald and Belford); one dead specimen.

87. P. CROSSEI, Brazier, 1877.

Illus^{n}.—Ann. Mus. Gen. XIX. pl. 10, figs. 18, 19.

Descr^{n}.—P.L.S.N.S.W. (1), I. 111; Ann. Mus. Gen. XIX. 267.

Type in Macleay Museum.

Hab.—Yule Island (Brazier).

I am indebted to Mr. John Brazier, F.L.S., C.M.Z.S., for the following description :—

88. "P. TAPPARONEI, Brazier, n.sp.

(Plate XII., fig. 36.)

"Shell shortly rimate, oblong-ovate, rather solid, regularly and obliquely finely striate, light brown; spire gradually tapering towards the rather pointed apex; whorls 6, four upper convex, the fifth slightly flattened on the side of the mouth, the last much narrower; aperture vertical, circular; peristome whitish, thickened, expanded and reflected, with two channels; one very small, narrow, and deep at the insertion of the right margin, the second shallow and surrounded with thick callus between the arcuate body-margin and the left or columellar. Length of largest specimen 18, breadth 8; length of smallest specimen 14, breadth 7 mm.

"Type in Australian Museum.

"Hab.—Fly River, British New Guinea (Froggatt).

"Two specimens—one living, the other dead—of this very rare species were collected by Mr. W. W. Froggatt when he went in

by the lateral canal, peristome thickened slightly and reflected. Length 8, breadth 6 mm.

Type in Queensland Museum.

Hab.—Mita, Milne Bay (Hedley); six specimens, under logs in dense jungle on hillsides; rare.

90. P. GIBBA, n.sp.

(Plate XII., fig. 38.)

Shell minute, oblong, smooth and extremely glossy; colour pale corneous; whorls 5, last convex, rather flattened below the suture, penultimate gibbose, tumid; spire ¼ of total length; apex obtuse; suture margined by a callus, impressed; aperture subvertical, circular, anterior canal distinct, lateral, a narrow cleft across the peristome developing outside the lip, a circular orifice, parietal lamella obscure, peristome slightly thickened and reflected. Length 4, breadth 2 mm.

Type in Queensland Museum.

Hab.—Mission Hill, Ngauauni, Upper St. Joseph River (Hedley); four specimens under logs in jungle upon the hillside.

91. DIPLOMMATINA SYMMETRICA, n.sp.

(Plate XII., fig. 39.)

Shell dextral, rimate, elongate, ovate, turreted, thin, translucent; colour reddish-corneous; whorls 7, rounded, increasing regularly as far as the antepenultimate, which equals its successor in breadth; sculpture, closely obliquely ribbed by thin white erect lamellæ, not continuous, projecting at the shoulder, minutely spirally striated between the ribs; suture deeply impressed; apex obtuse; aperture subvertical, circular, columellar margin straight, bearing a moderate-sized internal tubercle, peristome double, greatly expanded round its entire margin, forming a broad callus upon the penultimate whorl. Alt. 3½, breadth 1½ mm.

Type in Queensland Museum.

Hab.—Basilaki (formerly called Moresby) Island (Hedley); found abundantly upon decaying leaves of *Pandanus* upon a steep hill side.

92. Cyclotropis papuensis, Tapparone-Canefri, 1883.

Illus^{n}.—Ann. Mus. Gen. xix. pl. 10, figs. 22, 23.

Descr^{n}.—L.c. xix. p. 279.

Type in Genoa Museum.

Hab.—Fly River (D'Albertis).

93. Cyclotus poirieri, Tapparone-Canefri, 1883.

Illus^{n}.—Ann. Mus. Gen. xix. pl. 10, figs. 6, 7.

Descr^{n}.—L.c. xix. 254.

Type in Genoa Museum.

Hab.—Fly River (D'Albertis).

94. C. tristis, Tapparone-Canefri, 1883.

Hab.—Milne Bay, Mita and South shore (Hedley); twelve dead and immature specimens, in jungle under logs. The best preserved but immature specimen which furnished the figure had not attained the adult peristome.

96. C. KOWALDI, n.sp.

(Plate XII. *bis*, fig. 41.)

Shell turbinate, openly umbilicated; colour fulvous, faintly radiately painted with dark brown; whorls 5½, rounded, obscurely bicarinate; suture channelled; apex mammillate; sculpture, the body whorl is encircled by about 15 lyræ, two of which, one at and one above the periphery, attain more prominence developing into keels, within the umbilical funnel the lyræ are closer, smaller and more numerous, the lyræ are decussated by costæ at the junction of which an epidermal bristle is generally developed; peristome in the individual observed thin and therefore probably juvenile. Operculum not received. Diam. maj. 9, min. 7, alt. 6 mm.

Type in Queensland Museum.

Hab.—Sudest Island, Louisiades (Kowald and Belford); one specimen.

97. C. BELFORDI, n.sp.

(Plate XII. *bis*, fig. 42.)

Shell trochiform, narrowly umbilicated; colour fulvous-brown; whorls 4½ (juv.?), acutely carinated; suture channelled; apex mammillate; sculpture, spiral lyræ decussating radiate costæ, the acute carina of the periphery bearing a single row of long bristles, peristome sharp (juvenile?). Operculum wanting. Diam. maj. 4½, min. 4, alt. 4½ mm.

Type in Queensland Museum.

Hab.—Mita, Milne Bay (Hedley); two specimens.

I describe these Cycloti from imperfect material with some hesitation; none have been before recorded from this neighbourhood, and I trust that their marked characteristics will enable

subsequent observers to recognise them. The two latter species are named after Messrs. Charles Kowald and George Belford whose collections have been so frequently referred to in preceding pages.

98. †LEPTOPOMA VITREUM, Lesson, 1830.

Syn.—*luteum*, Quoy and Gaimard, 1832; *nitidum*, Sowerby, 1843.

Illus^n.—Voy. "Coquille," Moll. pl. 13, figs. 6, 6'; Voy. "Astrolabe," Moll. pl. 12, figs. 11, 12, 13, 14; Sow. Thes. Conch. I. pl. 29, figs. 225, 226, 227; Reeve, Conch. Syst. pl. 183, fig. 2; Reeve, Conch. Icon. XII. pl. 3, fig. 15a, b, pl. 6, fig. 32; Chem. Conch. Cab. ed. 2, pl. 16, figs. 10, 16, 17, 18; Adams, Gen. Moll. pl. 85, figs. 7, 7a, 7b, Chenu, Man. Conch. figs. 3602, 3603; Cox, Aust. L. Shells, pl. 16, figs. 2, 2a, 3; Tryon, Struct. Syst. Conch, II. pl. 76, figs. 3, 4.

100. L. PARVUM, n.sp.

(Plate XII. *bis*, fig. 43.)

Shell small, narrowly perforate, globosely turbinate, thin, translucent; colour light corneous, apex pink; whorls 5, rounded; sculpture, upon the body whorl, 15 minute raised spiral lines, 10 above the periphery and 5 below, which latter are confined to the outer half of the base, penultimate whorls encircled by 10 such lines, everywhere microscopically obliquely striated; apex acute; suture impressed; aperture subcircular, peristome almost continuous, slightly expanded and reflected, operculum not observed. Length 6, breadth 5 mm.

Type in Queensland Museum.

Hab.—Milne Bay (Hedley); one dead specimen.

I overlooked this species until my return to Australia, when I discovered a solitary shell in a bottle filled and closed in Milne Bay. I was in the habit of daily purchasing by the handful shells, beetles, and other small fry from the natives, and I conclude that I received this shell unnoticed among other things.

Recorded from the province in error.

L. VENUSTULUM, Tapp.-Can.

Vide Ann. Mus. Gen. XIX. 263, and XXIV 185.

101. HELICINA COXENI, Brazier, 1876.

Illus[n].—Ann. Mus. Gen. XIX. pl. 9, figs. 12, 13; p. 275, fig. g.

Descr[n].—P.L.S.N.S.W. (1), I. 111; Ann. Mus. Gen. XIX. p. 274.

Type in Macleay Museum.

Hab.—Yule Island (Brazier, D'Albertis); Rigo, Port Moresby and Maiva (Hedley).

102. H. DENTONI, Pilsbry, 1890.

Descrn.—Proc. Acad. Philad, 1890, p. 186.

Type in Phil. Acad. Museum.

Hab.—British New Guinea (Denton).

103. H. SOLITARIA, E. A. Smith, 1887.

Illusn.—Ann. Mag. Nat. Hist. (5), XIX. pl. 15, fig. 10.

Descrn.—L.c. (5), XIX. 425.

Type in British Museum.

Hab.—Foot of Astrolabe Range (Goldie) ?

104. H. FISCHERIANA, Montrouzier, 1863.

Syn.—*novo-guineensis*, Smith, 1887 ; *congener*, Smith, 1889.

Illusn.—Journ. de Conch. XI. pl. 5, fig. 3 ; Ann. Mag. Nat. Hist. (5), XIX. pl. 15, figs. 11, 11a ; l.c. (6), IV. pl. 13, fig. 17.

Descrn.—Journ. de Conch. XI. 76, 171 ; Mon. Pneu. Viv.

Type in British Museum.

Hab.—Duchateau Islets, Louisiade Archipelago (Forbes).

106. H. INSULARUM, n.sp.

(Plate XII. *bis*, fig. 44.)

Shell depressedly trochiform, sharply keeled; colour light yellow, usually unicolorous, occasionally with a spiral chestnut band above the periphery, occupying the central third of the space between the keel and the suture, more rarely the band broadens till the keel and a sutural thread alone remain yellow; whorls 4½, flattened; suture linear; apex acute; sculpture, 9 spiral lyræ above the periphery and 20 below it crossed by close incremental striæ; basal callus well defined, malleated, centre of base smooth; aperture subvertical, lunate, within the basal margin containing a thread-like rib which retreats to the columella, peristome everywhere expanded. Diam. maj. 14, min. 11, alt. 10 mm.

Type in Queensland Museum.

Hab.—Sudest Island, Louisiades (Kowald and Belford); abundant.

var. *sinus*, var.nov.

(Plate XII. *bis*, fig. 45.)

Much smaller than type, six lyræ above, sixteen below the periphery. Diam. maj. 8, min. 7, alt. 5 mm.

Hab.—Village of Mita, Milne Bay, and village of Polatona, Bently Bay (Hedley); abundant, found crawling upon shrubs and trees.

var. *muruensis*, var.nov.

Diam. maj. 10, min. 8, alt. 6 mm.

Hab.—Murua or Woodlark Island (Kowald and Belford); abundant.

var. *trobriandensis*, var.nov.

Diam. maj. 11, min. 9, alt. 8 mm.

Hab.—Trobriand Islands (Kowald and Belford); eight specimens.

var. *rosselensis*, var.nov.

Whorls more convex, colour rose with apex and callus yellow. Diam. maj. 9, min. 8, alt. 7 mm.

Hab.—Rossel Island (Kowald and Belford); abundant.

This species is evidently a dominant form, and may be expected under one of its aspects from any island in the Louisiades and neighbouring archipelagos.

Var. *sinus* is almost entitled to specific rank; it makes a distinct advance towards *H. stanleyi*, and in another direction var. *rosselensis* approaches *H. woodlarkensis*.

107. H. WOODLARKENSIS, E. A. Smith, 1891.

(Plate XII. *bis*, fig. 46.)

Descrⁿ.—Ann. Mag. Nat. Hist (6), VII. 138.

Type in British Museum.

Hab.—Woodlark Island (Dr. Rabe *fide* Brazier, Kowald and Belford).

109. H. MAINO, Brazier, 1876.
(Plate XII. *bis*, fig. 47.)

Descr^n.—P.L.S.N.S.W. (1), I. 112; Ann. Mus. Gen. XIX. 276, XXIV. p. 188.

Type in Macleay Museum.

Hab.—Village of Mowatta, Katow River (Brazier).

Drawn from the type by the kind permission of Mr. Masters, Curator, Macleay Museum.

"Maino" signifies "peace" in the local dialect.

110. H. MULTICORONATA, n.sp.
(Plate XII. *bis*, fig. 48.)

Shell minute, globosely conical; colour dull yellow; whorls 4½, rounded, slightly turreted; sculpture, upon the last whorl a fine thread-like keel at the periphery, the space between that and the suture divided by three similar keels, the earlier whorls exhibit only the three upper keels, each keel bears minute, erect, epidermal bristles, which give the shell a somewhat coronated appearance under the lens; base rounded, faintly concentrically and longitudinally striated; callus smooth, semi-transparent; aperture vertical, semi-lunate, red within, lip slightly expanded. Diam. maj. 4, min. 3½, alt. 4 mm.

Type in Queensland Museum.

Hab.—Village of Mita, Milne Bay (Hedley); one specimen.

Doubtful.—*H. leucostoma*, Tapparone-Canefri (Ann. Mus. Gen. XIX. p. 277, fig. h), may belong to this province, but the locality is not defined by the author.

(Anatomical Supplement to follow.)

EXPLANATION OF PLATES.

PLATE IX.

Figs. 1, 2. —*Oxytes hercules*, Hedley.
Figs. 3, 4. —*O. fyensis*, Hedley.
Fig. 5. —*Conulus starkei*, Brazier. Magnified.
Fig. 6. —*C. maino*, Brazier. Magnified.
Fig. 7. —*Microcystina sappho*, Brazier. Magnified.
Fig. 8. —*M. calcarata*, Hedley. Magnified.

EXPLANATION OF PLATES *(continued)*.

PLATE X.

Fig. 9. —*M. calcarata*, Hedley. Magnified.
Fig. 10. —*Thalassia annula*, Brazier.
Fig. 11. —*Ochthephila albertisi*, Brazier
Fig. 12. —*Charopa texta*, Hedley. Magnified.
Fig. 13. —*Helicarion vosi*, Hedley.
Fig. 14. —*H. musgravei*, Hedley.
Figs. 15, 16. —*Rhytida globosa*, Hedley.
Figs. 17, 18, 19.—*Cristigibba macgregori*, Hedley.
Fig. 20. —*Geotrochus oxystoma*, Smith.

PLATE XI.

Fig. 21. —*Geotrochus oxystoma*, Smith.
Figs. 22, 23. —*G. beraui*, Brazier.
Figs. 24, 25. —*G. elisus*, Hedley.
Fig. 26. —*G. tapparonei*, Smith.
Fig. 27. —*G. zeno*, Brazier.
Fig. 28. —*G. trobriandensis*, Hedley.
Fig. 29. —*G. brumeriensis*, Forbes

PLATE XII.

Fig. 30. —*Cochlostyla papuensis*, Hedley.
Fig. 31. —*Partula occidentalis*, Hedley.
Fig. 32. —*Succinea simplex*, Pfeiffer.
Fig. 33. —*Omphalotropis brazieri*, Hedley. Magnified.
Fig. 34. —*O. protracta*, Hedley. Magnified.
Fig. 35. —*Bellardiella minor*, Hedley. Magnified.
Fig. 36. —*Pupinella tapparonei*, Brazier. Magnified.
Fig. 37. —*Pupina ovalis*, Hedley. Magnified.
Fig. 38. —*P. gibba*, Hedley. Magnified.
Fig. 39. —*Diplommatina symmetrica*, Hedley. Magnified.

PLATE XII. *bis.*

Fig. 40. —*Cyclotus horridus*, Hedley. Magnified.
Fig. 41. —*C. kowaldi*, Hedley. Magnified.
Fig. 42. —*C. belfordi*, Hedley. Magnified.
Fig. 43. —*Leptopoma parvum*, Hedley. Magnified.
Fig. 44. —*Helicina insularum*, Hedley.
Fig. 45. — „ „ var. *minus*. Magnified.
Fig. 46. —*H. woodlarkensis*, Smith. Magnified.
Fig. 47. —*H. maino*, Brazier. Magnified.
Fig. 48. —*H. multicoronata*, Hedley. Magnified.

ON THE TRAIL OF AN EXTINCT BIRD.

By C. W. De Vis, M.A., Corr. Mem.

The function of the wing in birds is in kind almost uniform, though in exercise it varies greatly. It is therefore probable that any variation observable in the form or relative dimensions of a constituent bone of the wing (the ulna, for example) has been brought about solely by the habitudes of the bird, or those of its ancestors, in the use of the power of flight. The extent of the variation so produced will be comparatively limited: inconspicuous, indeed, by the side of the results of diverse adaptation acting on the corresponding segment of the mammalian fore-limb. We are thus prepared to find the ulna maintaining in birds a general sameness of character. If we compare it with the humerus its uniformity is but accentuated: and naturally so since its surface is less subjected to the moulding agency of muscular origin and insertion than is that of the proximal segment of the lever, the recipient of the muscles moving the whole, and the purveyor of others which give motion to the distal segments. These considerations may serve to account for the fact that the differentiations of the ulna have been found too insignificant to be discussed by comparative osteology; and undoubtedly the bone is not that part of the bird's skeleton which throws most light on its general economy, yet it may be that it is not altogether impossible to find in the fossil ulna of a bird some guidance to the systematic place which should be assigned to the organization of which it formed a part. In the following attempt to do so the characters which have appeared to be available are the proportions of the bone discovered in its relative length and thickness, its curvature, the number, size and disposition of the tubercles corresponding to the secondary remiges, the shape of the shaft at its distal end, and the conformation of the articulating surfaces and parts adjacent to them.

Proportions: The ulna being in correlation with the rest of the wing bones, and, in conjunction with them, determining to some extent the shape of the complete organ, and this again being in relation with the volant activity of the bird, we might expect to be able to recognise a correspondence between the proportion of the bone and the bird's habits of flight; and in certain groups, as the petrels, swifts, and eagles, whose livelihood depends on continuous exertion of wing-power, we find that such a relation does exist. In the soaring birds there is a notable slenderness of the ulna, accompanying an elongation and narrowness of the wing, which we may conceive to be necessary to sustained buoyancy upon and rapid evolution in moving air; and had adaptation persisted in being the sole factor in the formation of the wing the task of placing an unknown bird amongst its kindred, as determined by their powers of flight, would have been comparatively easy. But it is clear that teleology may be at fault. A similar tenuity of the ulna is found in birds whose flight is not habitually sustained, though on occasion it may be long and rapid

To acquire a definite notion of the extent to which the bird ulna varies in its proportions, the writer has prepared a tabular statement of the extreme length and minimum breadth of the bone from measurements of it in ninety-eight representatives of the larger sections of Australian birds; and from the measures of length and breadth has by the use of the formula, $\frac{\text{transverse}}{\text{longitudinal}} \times 100$, derived an index which may be called the ulnar index. By this proportions may be conveniently estimated, slenderness increasing as the index diminishes. The lengthiness of the entire table prohibits its introduction here; a summary may, however, be given if accompanied by the warning that in some families the indices are derived from one or two species only.

Table of Ulnar Indices in Birds.

Falconidæ	3·6	to	5·37
Strigidæ	4·05	—	4·64
Corvidæ	6·15	—	6·25
Paradiseidæ	6·11	—	7·94
Oriolidæ	6·74	—	7·6
Campophagidæ	5·39	—	7·55
Menuridæ	8·36	—	8·75
Ptilonorhynchidæ	6·62	—	6·85
Cuculidæ	3·9	—	7·53
Alcedinidæ	3·8	—	4·7
Caprimulgidæ	6·43	—	—
Coraciadæ	5·2	—	—
Psittaci	4·94	—	8·6
Columbæ	5·50	—	9·33
Megapodidæ	5·4	—	10 51
Otididæ	2·96	—	3·14
Rallidæ	4·92	—	8·28
Charadriidæ	3·65	—	5·91
Ardeidæ	2·81	—	4·67
Anatidæ	3·73	—	7·46
Pelecanidæ	3·4	—	5·16
Steganopodes	3·24	—	3·58
Podicipitidæ	3·69	—	4·69

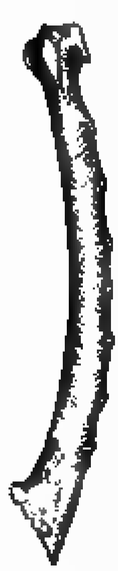
The fossil ulna which has led to these measurements is in its greatest diameter 47·5 mm.; in its smallest, 3·5 mm.; it has consequently an index of 7·38.

Proceeding to compare it with those of recent birds, we may at once exclude from further consideration those which have a greatest index below 7·38, or a smallest index above it. Nine families will then remain, the *Paradiseidæ*, *Oriolidæ*, *Campophagidæ*, *Cuculidæ*, *Psittaci*, *Columbæ*, *Megapodidæ*, and *Anatidæ*.

Form of Shaft: The ulnar shaft in birds assumes towards its distal end four modifications of form, which may be distinguished as cylindrical, subcylindrical, compressed, and trihedral. It is compressed in the *Paradiseidæ* and *Cuculidæ;* subtrihedral in the *Megapodidæ;* cylindrical in the *Psittaci*. In the remaining five families, and in the fossil, it is subcylindrical, the cylinder being flattened on the dorsal surface.

Curvature of Shaft: To afford space for the interosseous bodies and tendons of the long flexors and extensors the avine ulnar curves outwards, the curvature varying considerably in degree

The regularly arched ulnas found among the ducks have remigial tubercles which are either small and low, or evanescent. The pigeons have them constantly, and sometimes in pronounced development. In *Lopholaimus antarcticus* they are almost as large relatively to the size of the bone as in *Menura*, in which they attain a greater size than in any other bird known to the writer. In the fossil ulna they are as distinct as in *Lopholaimus*, although the bone itself is much more slender than the ulna of that pigeon. It is amongst the pigeons, therefore, that we must place our extinct bird. It remains to ascertain its position among the genera of the *Columbæ*. It cannot be a *Leucosarcia*, for the ulnar index in that genus is much too high—namely, 9·33. On the other hand, *Lopholaimus*, with an index ranging from 6·43 to 6·57, *Goura* with a range from 5·50 to 5·71, *Myristicivora* with an index of 6·8, and *Megaloprepia* with one of 6·64 may be excluded for the opposite reason. The middle terms are *Macropygia*, having an index of 7·85 to 8·05, *Erythrauchen* (index 7·79 to 8), and *Chalcophaps* (index 7·18 to 7·79), which last might include the fossil, with an index of 7·38. But though in proportions it is at one with *Chalcophaps*, on a close comparison of its arthral surfaces with those of the genera referred to it is in them found to resemble more nearly *Megaloprepia* and *Erythrauchen*. Finally, a glance at the size of the remigial tubercles of the fossil gives decision to the opinion, already half formed, that it belonged to a genus of pigeons distinct from all three. The name suggested for the supposed genus, *Lithophaps*, is, of course, provisional, since it connotes distinctive features which may, when we know more of the skeleton, be found to coexist with characters assimilating it to some known genus; it merely records a seemingly reasonable judgment on the scanty evidence before us.



The characters of the genus so far known are those of the ulna. *Ulna* stout, index 7·38, subcylindrical, continously arched, with a single row of eight strong remigial tubercles; arthral surfaces nearly as in *Megaloprepia*.

The species may be distinguished as *L. ulnaris*, with characters as yet undistinguishable from those of the genus.

Hab: Darling Downs, in deposits of the Nototherian period. Collected by Mr. H. Hurst, in the neighbourhood of Warwick.

NOTE ON AN EXTINCT EAGLE.

By C. W. De Vis, M.A., Corr. Mem.

In company with *Lithophaps ulnaris*, Mr. Hurst found a femur of an eagle which is irreconcilable with any genus known to the writer. But, in the "Proceedings of the Royal Society of Queensland" (Vol. vi., p. 161), a humerus of an eagle has been noticed by him under the name of *Uroaetus brachialis*. The bird was there referred provisionally to the extant genus as being in accord with it so far as one extremity of a long bone could bear witness. It has now become more than doubtful whether its association with *Uroaetus* can be maintained. If we are not prepared to consider it more probable that two species of eagles existed in practically the same habitat than that the two bones in question belonged to the same bird, and of this there is nothing valid to be shown to the contrary, then the specific name *brachialis* must be placed under a new genus, for the femur is quite distinct from those of recent genera. For this probable genus the name *Taphaetus* is suggested in allusion to its appearance among the disentombed remains of its contemporaries.

Restoring the condylar region, which is wanting, this bone is of the same length as that of the male sea-eagle, *Haliastur leucogaster*, and 7½ mm. shorter than in a female wedge-tailed eagle, *U. audax*. The femoral index 9·4 separates it alike from the hawks and kites, with a much lower, and from *Baza* which has for a hawk the exceptionally high one of 10·4 ; it likewise excludes *Haliaetus*, which has the highest observed in the Falconidæ, 10·88, but agrees fairly well with that of *Uroaetus*, *Nisaetus*, *Haliastur*, and *Pandion* ; the last named genus is, however, put out of court by the want of a pneumatic foramen adjacent to the trochanterian ridge, an abnormality not presented by the fossil. From the other

genera it differs as follows :—The "neck" being longer the proximal end of the shaft is in consequence notably broader—the neck itself is also broader in the opposite direction between the head and the trochanter. The entoanconal surface of the upper part of the shaft as far as the *extensor cruris* ridge is much flattened, and between the head and the pneumatic foramen becomes concave. The pneumatic foramen is remarkably small, about half its customary size in recent genera, and is partially concealed by a deflection of the sharp edge of the trochanterian ridge. When the bone rests on its outer side the flattening of the anconal surface proximally and of the palmar distally brings into prominence the pectineal ridge, which thus forms a high and sharp inner margin; this ridge is continuous from the outer condyle to within a short distance

Femur stout (index circ. 9·4), proximal end transversely expanded, shaft compressed, pneumatic foramen small; a rudimentary third trochanter, entepicondylar pit between condyle and epicondyle.

NOTES AND EXHIBITS.

Mr. Musson sent for exhibition a collection of 63 species of New Zealand land and freshwater mollusca collected by him during a recent visit, and determined by Mr. Suter, of Christchurch.

Mr. De Vis sent for exhibition the bones of fossil birds described in his papers.

Mr. Hedley exhibited a number of the more remarkable land shells from New Guinea in illustration of his paper.

Mr. Trebeck exhibited galls of certain diptera (*Phytomyzidæ* and *Cecidomyidæ*) from Mount Wilson.

Dr. Cox exhibited a specimen of the rock lily (*Dendrobium speciosum*), throwing off a bud in a somewhat remarkable manner.

Mr. Skuse drew attention to an interesting article in the last number of the *Pharmaceutical Journal of N.S.W.*, on insects injurious to drugs, one of them probably the same species of moth as was exhibited by Mr. Froggatt at the Society's meeting in March, 1890, the insects shown having pupated in a tin of cayenne pepper.

Mr. Fletcher exhibited for Mr. J. H. Rose two living specimens of an inland species of frog (*Chiroleptes platycephalus*, Gthr.), obtained near Walgett, previously only recorded from Bourke and Dandaloo, N.S.W. It is nocturnal in its habits and an expert burrower, Mr. Rose reporting that he has never met with it above ground during the daytime.

Mr. A. Sidney Olliff exhibited specimens of the cottony-cushion or fluted scale (*Icerya purchasi*, Mask.) and a number of larvæ and perfect insects of *Vedalia cardinalis*, Muls., the predatory lady-bird that was introduced into California last year by the United States Department of Agriculture for the purpose of keeping the former insect, which had been the cause of great loss to orange-growers, in check. The lady-birds had been kindly forwarded to him from Auckland, N.Z., by Mr. T. F. Cheeseman, the Curator of the Auckland Museum, who states that the species is at present (March 16th) engaged in clearing off a colony of *Icerya* on a hedge of Kangaroo Acacia not far from his house. Mr. Olliff said that Mr. A. Koebele states in his official report on his mission to Australia ("Report of a Trip to Australia to investigate the Natural Enemies of the Fluted Scale": Washington, 1890), that he had obtained the *Vedalia* at Adelaide and Mannum in South Australia, and in Melbourne, and Sydney; but it was a remarkable fact that the insect was not known to our most active workers at the Coleoptera, and that it was not represented in any

WEDNESDAY, 29TH APRIL, 1891.

The President, Professor Haswell, M.A., D.Sc., in the Chair.

Messrs. George Ellis, C. A. Chesney, and Rainbow were introduced as visitors.

Mr. C. Hedley, F.L.S., who retires from the position of Corresponding Member in consequence of taking up his residence in Sydney, was duly elected an Ordinary Member of the Society.

DONATIONS.

"Agricultural Gazette of N.S.W." Vol. ii., Part 2 (Feb., 1891). *From the Director of Agriculture.*

"Bulletin de la Société d'Etude des Sciences Naturelles de Reims." 1re Année, No. 1 (Jan., 1891). *From the Society.*

"Catalogue of the Australian Birds in the Australian Museum. Part iii., Psittaci;" "Records of the Australian Museum." Vol. i., No. 6. *From the Trustees.*

"Perak Government Gazette." Vol. iv., Nos. 4-6 (Feb.-March, 1891). *From the Government Secretary.*

"Zoologischer Anzeiger." xiv. Jahrg. Nos. 356-358 (Feb.-March, 1891). *From the Editor.*

"Johns Hopkins University Circulars." Vol. x., Nos. 85 and 86 (Feb. and March, 1891). *From the University.*

"Journal of Comparative Medicine and Veterinary Archives." Vol. xii., Nos. 2 and 3 (Feb. and March, 1891). *From the Editor.*

Pamphlet entitled "Insect-larva (*Cecidomyia* sp.) eating Rust on Wheat and Flax." By N. A. Cobb and A. S. Olliff. *From Dr. Cobb.*

"Bulletin of the Department of Agriculture, Brisbane." No. 7 (Botany, No. ii., March, 1891). *From the Colonial Botanist.*

"Journal of the Royal Microscopical Society, 1891." Part i. (Feb.). *From the Society.*

"Transactions of the Entomological Society of London, 1890." Part v. (Feb., 1891). *From the Society.*

"Pharmaceutical Journal of Australasia." n.s., Vol. iv., Parts 3 and 4 (March and April, 1891). *From the Editor.*

"Australasian Journal of Pharmacy." Vol. vi., No. 63 (March, 1891). *From the Editor.*

"Bulletin de la Société Belge de Microscopie." xvii^me Année,

"Comptes Rendus des Séances de l'Académie des Sciences de Paris." T. cxii., Nos. 3-5 (1891). *From the Academy.*

"United States National Museum. Bulletin." No. 32 (1887). *From the Director.*

"Memoirs of the Boston Society of Natural History." Vol. iv., Nos. 1-9 (1886-90); "Proceedings." Vol. xxiv., Parts 3 and 4 (1889-90). *From the Society.*

"United States Department of Agriculture; Division of Ornithology and Mammalogy—North American Fauna." Nos. 3 and 4 (1890). *From the Department.*

"Bulletin of the Scientific Laboratories of Denison University." Vol. v. (1890). *From the Editor.*

"Journal of the Cincinnati Society of Natural History." Vol. xiii., No. 3 (Oct., 1890). *From the Society.*

"Californian Academy of Science—Occasional Papers." Nos. i. and ii. (1890). *From the Academy.*

"Gesellschaft für Erdkunde zu Berlin—Verhandlungen." Bd. xiii.-xv., xvi., Nos. 1-8 (1886-89), xviii., No. 1 (1891); "Zeitschrift." Bd. xxi.-xxiii., xxiv., Nos. 1-4 (1886-89), xxvi., No. 1 (1891). *From the Society.*

"Zoological Society of London—Abstracts of Proceedings." Feb. 17th and March 3rd, 1891. *From the Society.*

"Bureau of Agriculture, South Australia—Journal." Vol. iii., No. 9 (April, 1891). *From the Secretary.*

"Proceedings of the Royal Society of Victoria." n.s., Vol. ii. (1889). *From the Society.*

"Achter Jahresbericht des naturwissensch. Verein zu Osnabrück" (1889 and 1890). *From the Society.*

"Katalog der Vogelsammlung im Museum der Senckenbergischen naturforschenden Gesellschaft in Frankfurt am Main. Von E. Hartert (1891)." *From the Society.*

Pamphlet entitled "North Italian Bryozoa." By A. W. Waters, F.G.S. *From the Author.*

"United States Geological Survey—Ninth Annual Report (1887-88);" "Bulletin." Nos. 58-61, 63, 64, and 66 (1890); "Mineral Resources for 1888;" "Monographs: Vol. i.—Lake Bonneville. By G. C. Gilbert (1890)." *From the Director.*

"Königlich-Böhmische Gesell. der Wissenschaften in Prag.—Abhandlungen der mathemat.-naturwissenschaft. Classe." vii. Folge, 3 Bd. (1889-90); "Jahresbericht, 1889;" "Sitzungsberichte." Jahrg. 1889, ii. Bd.; Jahrg. 1890, i. Bd.: "Uhlonosné Utvary v Tasmánii. Napsal Prof. Dr. O. Feistmantel (1890)." *From the Society.*

"Nederlandsche Entomologische Vereeniging.—Tijdschrift." xxxiii. Deel, Afl. 1 and 2 (1889-90). *From the Society.*

"Royal Society of N.S.W.—Journal and Proceedings." Vol. xxiv., Part 2 (1890). *From the Society.*

"Naturwissenschaftl. Verein des Reg.-Bez. Frankfurt—Monat-

PAPERS READ.

ON THE OCCURRENCE OF BARITE (BARYTES) IN THE HAWKESBURY SANDSTONE NEAR SYDNEY.

By Henry G. Smith, Laboratory Assistant, Technological Museum, Sydney.

(Communicated by J. H. Maiden, F.L.S., &c., Curator of the Museum.)

Uninteresting as the Hawkesbury sandstone around Sydney is generally considered to be, especially from a collector's point of view, and although the inducement to search for either metallic or non-metallic minerals is not great, yet sometimes one is rewarded for a diligent search among the cracks and crannies of old or recent excavations.

In a quarry not far from Cook's River, five miles west from Sydney, and adjoining the Illawarra-road in the borough of Marrickville, I recently found Barytes in very perfect and pure crystals. They have a vitreous lustre, which on the most perfect crystals is very brilliant; it was their sparkling in the sun that first drew my attention to them. They are in many instances as transparent as glass, and crystallise for the most part in modified tables of the right rectangular pyramid, the domes being cut off by the basal pinakoids. In many crystals the faces of the right rhombic prism are distinct; the symbols for the majority of the most perfect crystals are, therefore :— $\infty P + \bar{P}\infty + \breve{P}\infty + OP$. The pinakoids $\infty\bar{P}\infty$ and $\infty\breve{P}\infty$ being occasionally, although seldom, developed. The faces of the right rhombic prism are extended upon the macro-diagonal axis, and in a few larger crystals the extension has continued to the almost extinction of the macro-domes.

The purest and best formed crystals are of small size, but some measure $\frac{3}{4}$ inch on the macro-diagonal, though these larger crystals are not so pure nor so transparent; their thickness is $\frac{1}{16}$ inch.

The purest crystals were taken for qualitative analysis; just a trace of calcium was found, not a trace of strontium, no acid but sulphuric, the crystals consisting almost entirely of sulphate of barium. To remove any adhering ferric oxide or other accidental impurity they were boiled with dilute acid before fusion.

An exhaustive quantitative analysis would have been of little value, as it was impossible to separate the crystals from the grains of sand adhering to them; but two determinations were made to discover, if possible, in what proportion the sulphate of calcium was present. In the first ·4478 gram. SO_4 was obtained; this if combined entirely with barium would give 1·0861 gram. $Ba\ SO_4$; the bases were dissolved and precipitated by sulphuric acid and 1·0876 gram. obtained; this does not allow for any calcium, and as the second determination gave almost identical results, we may consider, allowing for slight errors, that the pure transparent crystals are $Ba\ SO_4$, the calcium being present in very minute quantities. $Ba = 136{\cdot}84$; $S = 32.$; $O = 16$.

It is in the conglomerate, which consists of boulders of shale

NOTES ON AUSTRALIAN ECONOMIC BOTANY—No. II.

By J. H. Maiden, F.L.S., &c.,
Curator of the Technological Museum.

FOODS.

Adansonia Gregorii, *F.v.M.* N.O. Malvaceæ. The "Bottle-tree"* of N.W. Australia.

From Mr. J. Pentecost, who spent some months in the Kimberley district, I learnt the following particulars in regard to these singular trees. Two or three were usually seen at a time, with a long interval. The fruits are rather larger than an emu egg (one in my possession has its diameters six and four inches respectively). The blacks, and Europeans too, chew the slightly acidulous pith or pulp. The seeds embedded in this pithy pulp taste like hazel nuts, and are a favourite food of the blacks. So valuable are these trees to them that they never notch the trunks nor injure the trees in any way in their pursuit of the fruit, as they do in the case of other trees.

Cocos nucifera, *Linn.* N.O. Palmæ. "Coco-nut"

This is a tree specially protected by enactments of the Queensland Parliament in the interests, chiefly, of the aboriginals and Polynesians. Legislation of this kind is so rare in the colonies that I have gathered some information in regard to this particular instance. Mr. Lewis Bernays, F.L.S., Clerk of the Parliaments, Brisbane, kindly informed me that the Acts referred to are the Pearl-shell and Bêche-de-mer Fishery Act of 1881, and also its Amendment Act of 1886. Through his kindness in forwarding

* For a fine plate, and excellent description of this tree, see J. R. Jackson in *The Student*, July, 1868.

me copies of both Acts I am able to quote clause 13 of the Amending Act, which is as follows:—"Any person who cuts down or injures a coco-nut tree, or other tree bearing edible fruit, or any tree of the kind known as *Calophyllum inophyllum* . . . . shall be liable to a penalty not exceeding £10."

I wrote to the Hon. John Douglas, C.M.G., Government Resident, Thursday Island, asking what was the effect of this legislation, and he courteously supplied the following information:—"Coco-nut trees are, I think I may say, religiously respected. We have not many matured trees in this immediate neighbourhood, though there are plenty in the islands in the Straits. A good many have lately been planted, and some of them are doing pretty well, but there are a good many failures. The *Calophyllum inophyllum*, of which there are very few specimens, is not likely to be touched by ruthless hands" (July, 1890).

STERCULIA DIVERSIFOLIA, *G. Don.* N.O. Sterculiaceæ. A "Kurrajong."

EUCALYPTUS GUNNII, *Hook. f.* N.O. Myrtaceæ.

For an exhaustive research on this manna, see "The Carbohydrates of manna from *E. Gunnii* and of Eucalyptus Honey." By F. W. Passmore, Ph.D. (*Pharm. Journ.* [3], XXI. 717).

Perhaps on account of the rain, there was so much manna on the Monaro last year, that if there were any sale for it it would represent a large sum annually for the district. Under large trees of *E. Gunnii* the ground is often literally covered, on the high lands above Cooma, and on the plains where both *E. Gunnii* and *E. viminalis* occur there is a great deal more. A family of children could gather a large quantity in a day, so that, if there were any sale for it, manna-collecting could become a useful minor industry during the summer months. Although last year it was particularly abundant, large quantities are obtainable every year.

From actual observation, the production of manna does not seem to be affected by either wet or dry weather, although of course the first shower of rain washes away all that has been formed since the previous shower.

SESELI HARVEYANUM, *F.v.M.* N.O. Umbelliferæ.

The "seed" of this fragrant plant is used in the Snowy Mountains as a substitute for caraways, and is locally known as "Anise." The seeds do not, however, resemble anise, particularly in flavour, but they are most like Indian fennel (*Fœniculum vulgare*, Gærtn.) in general appearance and perhaps in flavour, of all umbelliferous seeds which enter into commerce. The root, also, is aromatic. The plant is rather plentiful in the locality indicated, above 5000 feet, although it also occurs as low as from 3000-3500 feet.

STOCK POISONS.

BULBINE BULBOSA, *Haw.* N.O. Liliaceæ. "Native Onion."

This plant is recorded as poisonous to stock in Queensland and South Australia. Two years ago it was sent to me from near

Penrith, in this colony, with the report that it had poisoned cows in a paddock in which there was but little grass owing to the dry weather, and I was informed that horses either would not touch it or that it appeared to have no effect on them. I am aware that this is contrary to Queensland experience.

NICOTIANA SUAVEOLENS, *Lehm.* N.O. Solanaceæ. "Native Tobacco."

So many contradictory statements have been made in regard to the poisonous nature to stock, or the reverse, of this plant, that specific evidence is now necessary to settle the point once for all. In the *Journal Bureau Agric. S.A.*, Aug., 1890, it is stated that the plant has killed a number of cattle and pigs at Mannum, Terowie, and other parts of South Australia. The percentage of nicotine in the plant at various stages has never been ascertained, so far as I am aware; meantime we are ignorant as to the extent of its poisonous nature.

CASSIA SP. N.O. Leguminosæ.

SANTALUM CYGNORUM, *Miq.* (Syn. *Fusanus spicatus*, R.Br.).
Sandalwood oil from Western Australia.

It does not appear to be easy to obtain full particulars of the commerce in sandalwood and its products, which form no insignificant item in the trade of the western colony. My interest in the matter has been re-awakened by observing in the Sydney newspapers of September last a telegram from Perth, W.A., to the effect that "The newly-established Distillery Company, a short distance from Albany, shipped the first instalment of 20 cases of sandalwood oil to England." The resinous-smelling West Australian sandalwood (pronounced by Schimmel & Co. to be quite unsuitable to European requirements) goes to Singapore and China, to be burned as incense in Buddhist temples, and, doubtless, Malays and Chinese have exploited Western Australian sandalwood for centuries. Western Australia exported in 1889 to Singapore and China 4470 tons, of the value of £33,525.

As to the oil, I have received no reply from the Distillery Company in respect to it, nor have I observed any account of its reception in the London and Continental markets.*

SUBSTANCE REPUTED MEDICINAL.

VERBENA OFFICINALIS, *Linn.* N.O. Verbenaceæ.

I have received this plant from the north-west of this colony with an intimation that it is employed by the blacks in venereal complaints.

TIMBERS.

I give brief notes on the following timbers, which have not, so far as I am aware, been previously described.

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* Since the above was written I have obtained, by the roundabout way of London and Leipzig (*Chemist and Druggist*, and Schimmel and Co.), a few particulars concerning this oil. Its specific gravity is variously stated at ·953 and ·982; its odour as "much more fragrant than the Madras kind" and "sharp." Its colour is pale straw.

ACACIA PENNINERVIS, *Sieb.* "Mountain Hickory."

Although this tree is so abundant in the south, its timber does not appear to have come into general use, but an expert in the Bombala district considers it excellent, being very durable and very tough, on which account he prefers it to anything else for axe and tool-handles. It is said that the timber can almost be bent double upon itself. Trees obtained from high stony ridges are usually sound. The timber is flesh-coloured, has a pretty figure, and very little sap-wood. It is not easy to dress.

ACACIA TETRAGONOPHYLLA, *F.v.M.* A "Dead finish."

Timber very hard, heavy, tough, and close-grained. Its prevailing colour is reddish-brown, and it has pinkish stripes. It is well adapted for small turnery and cabinet work, but it is hard to work. When fresh it smells like violets. An interior species.

ACKAMA MUELLERI, *Benth.* (Syn. *Weinmannia paniculosa*, F.v.M.). N.O. Saxifrageæ. A "Corkwood."

little-figured, free-working timber, and though apt to rend in drying, repays attention to seasoning. A Mr. Foley, who, up to the time of his death a few years ago, was a road-maintenance man in the Bombala district, used to make pick, hammer, and axe-handles of this wood, which acquired considerable local reputation and were readily purchased. This is the origin of the local name, and it is an interesting example of the way plant names have been often given in this country.

Lomatia Fraseri, *R.Br.* N.O. Proteaceæ. "Lancewood."

Used for similar purposes to the preceding,—a timber which it much resembles. It is close in texture, has a pretty oak grain, and is of a very pale pink colour. It is difficult to plane.

Pomaderris cinerea, *Benth.* N.O. Rhamnaceæ.

Tough, close in the grain, dresses up fairly well, but is inclined to warp and split. It is moderately heavy, and the heartwood has a pleasing brown colour. It is hardly known, and appears to be never used. It is probably useful for tool-handles. Southern districts.

MISCELLANEOUS.

Mr. C. Hedley informs me that the natives of Northern Queensland, when hotly pursued, have often escaped from their enemies in the following manner. They break off the leaf-stalk of a water-lily, disappear in the waters of a lagoon or river, and breathe by means of this porous leaf-stalk, which extends from their mouths to the surface of the water. They have been known thus to remain concealed in water for half an hour. During President Carnot's tour in Corsica in 1889, it was related in the newspapers that a Frenchman had escaped from brigands by means of a similar expedient; he used a hollow reed, and made the statement that he had been under the surface of a certain lake four hours.

ON THE OCCURRENCE OF A GUM IN *ECHINOCARPUS (SLOANEA) AUSTRALIS*, BENTH.

By J. H. Maiden, F.L.S., &c.

This fine tree, usually known as "Maiden's blush" on account of the colour of its timber, belongs to the Natural Order Tiliaceæ, closely allied, of course, to the Sterculiaceæ and Malvaceæ, many of whose species yield gums.

The Tiliaceæ are also all more or less mucilaginous, but I cannot trace the record of a gum having been found on a plant, whether endemic in Australia or not, belonging to this Natural Order. Various Tiliaceous trees have their mucilaginous inner barks

under the teeth. It swells up in cold water to many times its original bulk, the outer portion becoming so transparent that it is difficult to distinguish it in the liquid, the inner portion remaining translucent and whitish. When pressed between the fingers the soaked gum does not feel gelatinous, although slightly adhesive.

In water it does not dissolve entirely on continued boiling, the liquid becoming slightly cloudy, with small filmy particles floating about in it. On acidifying with hydrochloric acid, the cloudiness and the particles alike disappear. The whole of the gum is precipitated when alcohol is added to this acidified solution. If this precipitate be then filtered off, the greater part is soluble in water. The undissolved portion is soluble in potash of ·1 per cent., but not in acidified solutions. If the potash solution be acidified with either acetic or hydrochloric acid, a glairy mass results.

It is instructive to compare this gum with Tragacanth and Sterculia gum.*

This gum agrees with Tragacanth in regard to the points given in the table at p. 384 *(op. cit.)*, with the following exceptions:—It does not entirely dissolve on prolonged boiling; forms a granular jelly like *Sterculia* gum on treatment with cold water, while Tragacanth forms a smooth viscid mass under similar circumstances; contains no starch.

It agrees with Tragacanth on the following points:—A yellowish colour with alkalis on heating; formation of the substance denoted by Giraud as pectic acid.† (I have in another place‡ commented on the unsatisfactory position of these so-called pectic bodies.)

Conclusion.—*Echinocarpus* gum appears to occupy an intermediate position between *Sterculia* gum and Tragacanth, with greater resemblance to the latter.

The specific gravity of the gum is 1·481.

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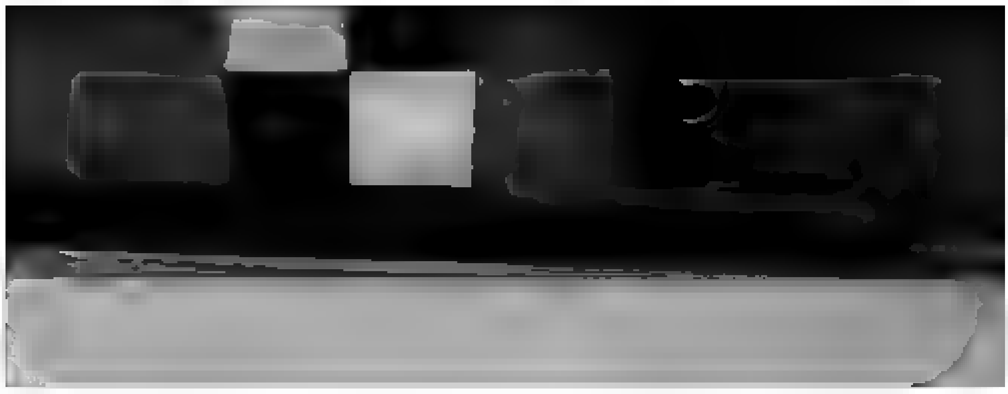
* See my paper, "Sterculia Gum; its similarities and dissimilarities to Tragacanth," *Pharm. Journ.* (3), xx. 381.

† *Pharm. Journ.* (3), v. 766.

‡ *Chem. and Drugg. of Austral.*, Feb., 1890.



Its composition may be stated as follows :—

Soluble in cold water (arabin)................	12·05
Soluble in ·1% soda (metarabin); yields arabin on precipitation with alcohol.......	39·8
Vegetable mucilage of Dragendorff; insoluble in ·1% acid, ·1% soda solution, but soluble in potash solution	20·91
Water..	18·73
Ash*...	4·486
	95·976

Composition of the Ash.

Soluble in water :—		
Potassium sulphate.............................		·436
Insoluble portion :—		
Calcium carbonate†...................	3·769	4·05
Magnesium carbonate.................	·281	
Alumina..................................	trace	
Ferric oxide.............................	trace	
Total..		4·486

* Placed in percentage composition for convenience.

† Probably originally existing as oxalate, as calcium oxalate was found in the original gum.

[redacted]

ONYX AND DIPELTIS:

NEW NEMATODE GENERA, WITH A NOTE ON DORYLAIMUS.

By N. A. Cobb.

I.

Fixation and Preservation of Compressed Objects.

Many sub-microscopic objects require to be compressed in order to give the best results at the final microscopical examination, and it is well known that compression cannot be accomplished conveniently (if at all) after hardening.

To illustrate by an example: the sub-cylindrical larvæ of dipterous insects if examined fresh are best seen in a compressorium, but much histological detail is thus seen with difficulty, or escapes observation altogether. If, however, it were possible to fix, stain and mount the larva while compressed, a distinct advantage would be gained. To describe a simple way of doing this is the object of these preliminary lines.

The object, say a dipterous larva or a rotifer or a tardigrade or nematode, is compressed between two small coverglasses of the same size. The amount of compression must be regulated by means of two hairs, or better by two pieces of spun glass, placed parallel to each other between the coverglasses. It will be found that hairs from the head, eyebrows, and backs of the hands are of different diameters, and a preliminary experiment will indicate which it is best to use. Having laid the animal, together with two hairs or bits of spun glass, on one of the covers in a drop of water which is too small to entirely fill the space between the covers

when they are finally placed together, lay the other cover on. The animal is compressed, and is unable to move. It will be found convenient to have laid the first cover on a minute drop of water on a glass object slide; by this means it will be held firmly in place on the slide, and the second cover can be laid squarely on; furthermore, after the second cover is adjusted the slide can be placed on the stage of a microscope and the animal then examined to see if its position is the correct one, and, if not, the fault can be rectified by sliding the upper cover slightly on the lower.

Supposing the object to be now correctly compressed and arranged, the next step is to fix the covers in place. This is done by moving the two covers to the edge of the slide by means of a needle and touching first one side of the pair and then the other side with the wick of a wax taper or candle which has been just now extinguished. The melted wax from the wick serves to cement the covers together, and they may be afterwards handled with considerable impunity. It will be remembered that directions were given to use less water than would fill the space between the

would be attained. To do this, proceed as follows:—Take an elongated piece of quill or other similar elastic non-metallic substance and make in it two cuts as shown at Fig 2 a,b. It will be

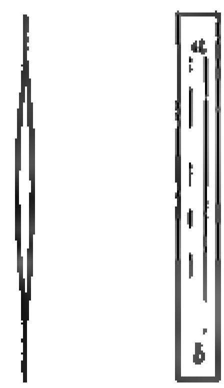


FIG. 2.—TWO VIEWS OF A PIECE OF QUILL, split and opened so as to form a compressorium.

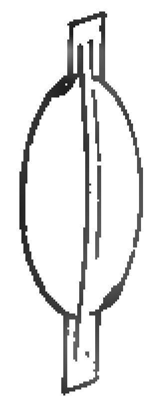


FIG. 3.—TWO ROUND COVER-GLASSES, cemented together and placed in a quill compressorium.

found that the piece of quill can then be opened and converted into a compressing machine. The covers are to be placed in this compressorium as shown in Fig. 3. Of course the compressorium of quill should be stiff enough to firmly hold the covers in place, *but should be no stiffer than will serve this purpose well.*

Our compressed animal is now ready for treatment, and may be handled like any other object. The quill will hold the covers firmly in place, even if the paraffin should become dissolved or melted. If no substance is to be used that will dissolve or melt the paraffin, then of course the compressorium of quill is unnecessary, as for instance when only cold solutions of glycerine are to be used and the object is to be mounted in glycerine. If, however, one wishes to fix in hot sublimate or to proceed at once to alcohols or other liquids that would have a loosening or solvent action on the paraffin, then of course the quill compressorium (or a different cement) is necessary.

To fix the object, take hold of the quill and place one edge of the covers in the fixing fluid; the fluid runs in by capillary attraction, and fixation takes place. The fixing fluid may be replaced by fresh fluid or can be washed out by the use of blotting paper in the ordinary way, *i.e.*, place one edge of the covers in the fluid it is desired to draw in and place fresh blotting paper in contact with the opposite edge of the covers.

An excellent way is to make the whole apparatus represented in Fig. 3 so small that it can be readily introduced into the object box of a differentiator. When the object returns from the differentiator the compressorium is carefully removed and the object will be found not to adhere to the covers, providing they were originally clean. It would be difficult to exceed the perfection of objects thus treated. The covers should not lie horizontal in the differentiator, otherwise the time occupied in treatment will be lengthened owing to the difficulty with which the fluids will enter the space between them.

II.

The New Genus Onyx.

In the worms constituting the genus *Onyx* the structure of the head and neck is very characteristic, but at the same time the kinship with the genus *Dorylaimus* is at once evident. It will be presently seen, however, that the two genera are very distinct from each other.

As one would expect from the foregoing remark the pharynx in

function is the same as that of the ring in *Dorylaimus*, namely, to serve as a guide and support to the spear. Because of its affinity for carmine this threefold structure is usually conspicuous in specimens treated with that reagent. That portion of the œsophagus lying behind the pharyngeal bulb reminds one forcibly of the corresponding part in *Dorylaimus*, the narrow anterior half being surrounded near the middle of the neck by the nerve-ring, and joined to a stouter, nearly cylindrical, muscular posterior half, two-thirds as wide as the body.

Before describing the head it is necessary to premise that the cuticula is finely striated. The striæ in the single known species appear like plain transverse lines ·8μ apart, so that the total number in the cuticula of an adult worm is calculated at about twenty-seven thousand. The nearly cylindrical neck terminates anteriorly in a rounded head, which bears, far forward, two large and conspicuous spiral lateral organs. These commonly lie opposite to, or a little in front of, the cap of the spear. The striations of the cuticula cease on the head to be transverse. One

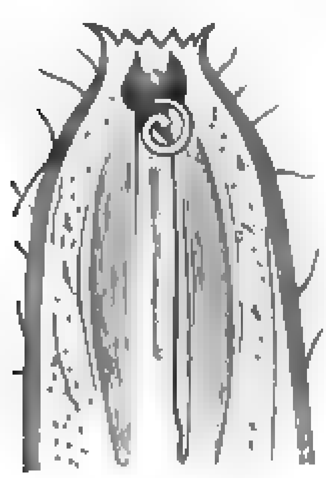


FIG. 4.—LATERAL VIEW OF THE HEAD OF ONYX PERFECTUS, with the mouth open and displaying lips. The pharyngeal bulb and its contained spear are clearly shown, as is one of the spiral lateral organs, and the spear-guide. The left hand side of the figure is dorsal. × 400.

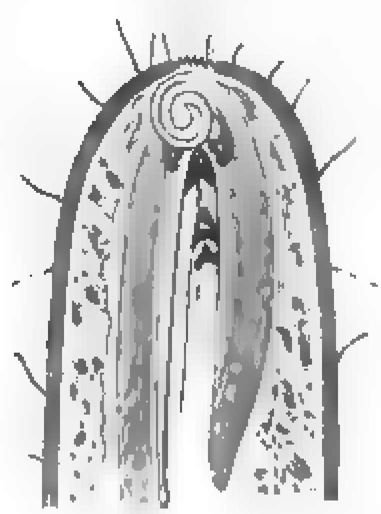


FIG. 5.—LATERAL VIEW OF THE HEAD OF ONYX PERFECTUS, with the mouth closed. The head of the spear is shown just behind the spiral lateral organ. Under the cap of the spear are two developing caps for future use, showing neatly the manner of dentition. The guides for the spear are partially hidden by the spiral organ. The right hand side of the figure is dorsal. × 400.

may observe them passing circularly around the lateral organs and on some parts of the head they are arranged *longitudinally* This

latter fact harmonizes with the manner in which the cuticula at the head expands to allow of the protrusion of the lips, which are ordinarily so far withdrawn that only the tips of their papillæ are visible. The peculiar action of the cuticula on the head may be compared to the opening and shutting of an inverted umbrella. When the lips and other mouth-parts are withdrawn, the cuticula is drawn together and disposes itself in longitudinal folds. When the mouth parts are thrust forth, and they can be thrust forth to a remarkable extent (see Figs. 4 and 5), the cuticula unfolds to permit the action, and the striæ become less visible.

I am not altogether clear about the muscles by means of which the foregoing movements are accomplished. It is possible that the mouth may be closed by an orbicular muscle or even by the elasticity of the cuticle. Threads, doubtless muscular, pass obliquely backward from the pharyngeal bulb and attach themselves to the body wall. These elements, if muscular, are of course retractile in function The pharyngeal bulb is also supplied

related genus, the manner of using the spear is quite different. The differences will be most clearly apprehended if their consideration be preceded by a short discussion of the mechanics of the Nematode spear taken in a general sense. The office of the spear is to puncture membranes which enclose the food-materials of its possessor—in most cases the walls of cells. For this operation it is necessary to have an opposing pull or inertia greater than the force which moves the spear forward. The inertia of the animal is not a sufficient reaction because of its small size and consequent lightness; therefore we find, for the production of a pull, in all cases where a spear is present, well-developed lips and a powerful sucking apparatus in the shape of a highly muscular portion of the œsophagus specially adapted to producing a partial vacuum. The lips are applied, suction is then exerted, and the mouth is thus made to firmly adhere to the membrane to be pierced. This force of suction is the mechanical "base of operations" for the action of the spear, and the pull of the suction must be greater than the force required to thrust the spear forward, otherwise the lips will let go their hold before the spear can accomplish its work.

In all the genera possessed of a spear, the action of the lips in obtaining a purchase is much the same, and in this respect, therefore, *Onyx* cannot be said to present marked peculiarities. When we come, however, to the manner in which the spear is thrust forward, we find marked differences, and *Onyx* presents one of the most marked types. The most emphatic morphological expression of the difference existing between *Onyx* and its congeners is the possession by the former of a distinct muscular pharyngeal bulb. There is no such bulb in any known species of *Tylenchus*, *Aphelenchus*, *Dorylaimus*, or other spear-carrying genus. In *Tylenchus* the spear is believed to be moved backward and forward by means of muscles attached to the three chitinous bulbs which constitute its posterior extremity. I believe, however, that no such muscles have been observed in *Dorylaimus*; in fact the spear in this genus appears to me often to be moved forward, not so much by muscles attached to itself as by muscles attached solely

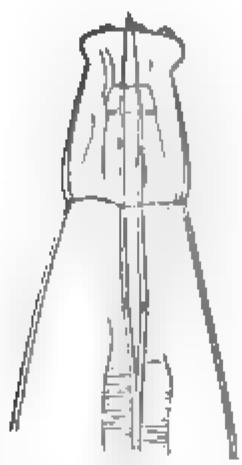


FIG. 6.—EXTENDED CONDITION OF THE HEAD OF DORYLAIMUS LATUS. That portion beyond the line marking a transverse constriction can be retracted within the skin of the posterior part. The spear is slightly protruded, and the ring through which it slides is clearly shown. × 450.

to the walls of the body, the facts being as follows. The species of *Dorylaimus*, as they ordinarily come under observation, present a rather low lip region, offering anteriorly no very remarkable peculiarities. An examination of the figures given by various authors of various species of *Dorylaimus* soon discovers a peculiar loop-like appearance apparently inside the head just behind the base of the lips. I say *apparently*, for these loops, which are visible *in whatever position the animal be viewed*, are in reality the optical expression of *an infolding* of the skin,—exactly such an infolding as occurs in the skin of a turtle's neck when the head is drawn partly within the carapace. The extended condition of the head

represented in the accompanying cuts. The manner in which this peculiar arrangement is made of service to the animal may be thus reasoned out. The head having been thrust out and the lips having obtained a purchase, the spear is moved forward by contracting the length of the body by means of muscles attached to the body wall inside the head. This contraction results in an infolding of the skin of the head. This reasoning is exactly in harmony with the usual position of the spear in *Dorylaimus*, for it is well known to be situated well forward, being in fact often normally a little exserted. Attention might also be called to the sinuous condition of the narrow anterior portion of the œsophagus as being also in harmony with the above view. The apparent disproportion between the length of the neck and that of the œsophagus might be thus explained.

We return now to *Onyx*. Passing from the œsophagus the food enters the intestine through a narrow cardia. The connection between the œsophagus and the intestine is unusually small, the diameter at the cardiac collum being not more than a sixth as great as that of the base of the neck. The thick wall of the intestine is built of a single layer of large cells, which are of such a size that half-a-dozen side by side make up a circumference. The width of the intestine where it is the sole occupant of the internal cavity is not far from four-fifths as great as the width of

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off than its posterior. The distinct lateral fields are of a lively brown colour and appear to terminate posteriorly in pores near the rounded terminus of the tail. Anteriorly they become narrower and apparently cease altogether in the neighbourhood of the nerve-ring. This latter is oblique and as wide as the œsophagus at the point encircled. The short tail is conical to the blunt terminus and is traversed transversely by distinct anal muscles. To the indistinct vulva succeeds a vagina supplied with a chitinous lining and the usual glands. The reflexed portions of the ovaries are narrow and filled with double rows of developing ova, and extend as far back as the vulva. The eggs are one-half as wide as the body and two to three times as long as wide, and are deposited before segmentation begins. The male is unknown.

Hab. Roots and stems of grass, Sydney, Australia, at all seasons.

the body. The rectum is of the usual form. There is no prerectal portion as in *Dorylaimus*.

The female sexual apparatus is double and symmetrical, each ovary being reflexed. The vagina is well developed, and is supplied with a chitinous lining and the usual vaginal glands. The male sexual apparatus is double and commonly directed forward throughout its extent, but sometimes having the ends of the testicles reflexed. The ductus ejaculatorius extends along that portion of the belly occupied by the row of accessory organs, and appears to be composed of a double row of cells much flattened in the direction of the axis of the body. The free extremity of each testicle is filled with from fifty to one hundred elongated structures arranged radially, but directed obliquely towards the axis of the organ. These bodies are granular and stain in carmine.

FIG. 7.—PROFILE VIEW OF THE VULVA OF ONYX PERFECTUS. The chitinous vagina is shown dark, and two unicellular glands are shown light. × 225.

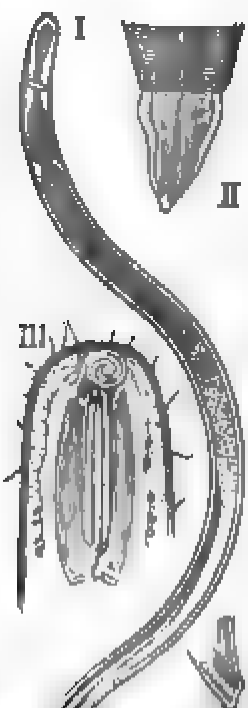
[redacted]

the remark that other species if carefully examined would perhaps prove to be also striated. Since making those observations I have confirmed the impression under which they were written, by the discovery of striæ in a number of other species of *Dorylaimus*. These striæ are generally most clearly visible near the posterior extremity of the animal. The occurrence of spiral markings on the head of *Onyx*, and of fine transverse striæ in its cuticula, coupled with the general resemblance to *Dorylaimus*, when taken in conjunction with the observation of fine striæ on many species of the latter genus and obscure spiral markings on two species, obviously give a new character to the group of Nematodes of which *Onyx* and *Dorylaimus* are representatives, and suggest new phylogenetic probabilities.

The worms belonging to the genus *Onyx* are readily recognised by the cylindrical neck and peculiar head. The single species now first described is called on account of the perfection of its development

ONYX PERFECTUS, n.sp. $\frac{4\cdot1}{3\cdot7}\ \frac{7\cdot3}{2\cdot9}\ \frac{15\cdot5}{3\cdot1}\ \frac{51}{3\cdot6}\ \frac{91\cdot5}{2\cdot2}$ 1·94 mm. The cuticula is traversed by twenty-seven thousand transverse striæ and bears throughout the length of the body very slender and rather long hairs These latter are, as usual, longer and more numerous near the head. where their length is about half as great as that of the diameter of the body. When the mouth is closed the anterior extremity is hemispherically rounded. The conspicuous lateral markings are so curved that the right hand one appears as a left-handed spiral passing through about 450° of angular space, and the left hand one as a corresponding right-handed spiral When the worm is placed in profile the spirals appear to be one-half as wide as the pharyngeal bulb, the latter being itself one-half as wide as the head. There are no eyes. When the mouth is closed the summits of the twelve pointed papillæ with which the lips are armed may be seen crowded together at the small orifice. When the mouth-parts are thrust forward, the points of the papillæ become separated from each other and then sometimes have the appearance commonly presented by the lips and papillæ of

Chromadora. The pharyngeal bulb is about one-fourth, the posterior or cardiac bulb about two-fifths, and the intermediate canal about one-third as long as the neck. While the cylindroid cardiac swelling is three-fourths as wide as the neck, the pharyngeal swelling is only one-half and the intermediate canal only one-third as wide as the neck. The slightly oblique nerve-ring has about the same width as the œsophageal canal it surrounds, and is accompanied by the usual groups of nerve-cells. The tail is slightly convex-conoid to the large conical terminus, which begins with a slight expansion. The widest portion of the terminus is one third as wide as



This species is common in the Bay of Naples, living in sand in situations occupied by *Amphioxus lanceolatus.* The absence of large marine algæ in its habitat leads me to surmise that it is a carnivorous species.

III.

The New Genus Dipeltis.

Nearly thirty years ago Eberth described in his "Untersuchungen über Nematoden," under the name of *Enoplus cirrhatus*, a peculiar marine Nematode whose like has not since been observed. I am interested, therefore, to find in my Ceylon collection a similar worm which enables me to confirm Bastian's statement that Eberth's species mentioned above was not an *Enoplus.* The observations I have made on the Ceylon species, coupled with observations on a new species taken in the Mediterranean, lead to the establishment of the new genus *Dipeltis.* The characteristics of this new genus are not numerous, but they are well marked. The head was described by Eberth as bearing on either side a peculiar oval plate. These "plates" are in reality an hitherto unknown form of the lateral organs. Each is an ellipsoidal structure nearly as wide as the head and having a thickened margin. Being rather more pointed anteriorly than posteriorly and extending to the very base of the lips, they give to the head of the worm when seen in profile a peculiar eel-like or fish-like appearance. In other particulars *Dipeltis* is in nowise very remarkable.

The cuticula, which may or may not bear conspicuous hairs, is very finely striated. The mouth was said by Eberth to be furnished with three papillæ. It appears to me, however, that these "papillæ" are rather to be denominated lips. One of them seems to be more pointed than the others—to be, in fact, spear-like. The œsophagus is simply conoid. The ventrally arcuate tail is supplied with caudal glands. Ocelli are present in some species.

1. Dipeltis minor, n.sp. Female unknown.

$\frac{1\cdot(?)\quad 6\cdot9\quad 19\cdot\quad M\quad 69\cdot}{1\cdot\quad 3\cdot\quad 3\cdot3\quad 3\cdot5\quad 1\cdot9}$ 1·36 mm. The cuticula bears no conspicuous hairs. The neck is conoid to near the slightly oblique nerve-ring, becoming thence more and more decidedly convex-conoid until it at last becomes rather suddenly almost acute at the mouth. The length of the ellipsoidal lateral organs is one-fifth as great as the distance between the mouth and the nerve-ring, and they are about one-half as wide as long. Their thickened margins present a double contour. Posteriorly the œsophagus becomes three-fifths as wide as the neck. The portion of the alimentary canal immediately behind the distinct cardiac collum is usually pressed to one side by the large ventral gland, which is two-thirds as wide as the body and twice as long as wide. The position of the porus is unknown to me. The simple, arcuate, linear spicula are of nearly uniform size throughout and are about as long as the anal diameter. An accessory piece less than half as long as the spicula is seen to curve inward and backward from the anus. The tail is [redacted]

The two equal, strongly arcuate, acute, linear spicula, which are a little longer than the anal diameter, terminate proximately in a distinct expansion, and are supported by a single accessory piece one-third as long, situated behind them and curving backward.

Hab. Mediterranean Sea. I have not seen this species.

3. DIPELTIS TYPICUS, n. sp. $\frac{\cdot 3}{\cdot 6} \frac{7\cdot 5}{1\cdot 7} \frac{10\cdot 7}{1\cdot 8} \frac{?}{2\cdot} \frac{92\cdot 9}{1\cdot 6}$ 1·7 mm. is the formula for the only female seen. The sexual organs were undeveloped, and their character and the position of the sexual opening remain unknown. The cuticula is traversed by about one thousand eight hundred and fifty transverse striæ so fine and obscure as to escape notice with ordinary powers. The head is armed with stout arcuate hairs arranged in four submedian rows of about a dozen hairs each. These rows extend backward to the region of the eye spots. The complex oval-shaped lateral organs are somewhat longer than the head is wide and one-half as wide as long. The mouth cavity is very small, and seems to be armed with a minute labial spear. The œsophagus is at first only one-fourth as wide as the neck, but as it passes backward it gradually increases in diameter and becomes at last, that is to say somewhat behind the oblique nerve-ring, one-half as wide as the neck. The intestine is about three-fourths as wide as the body. The rectum is only two-thirds as long as the anal diameter. The conoid tail is ventrally arcuate and ends in a conical outlet for the three caudal glands. The large unicellular ventral gland lies as far behind the cardiac collum

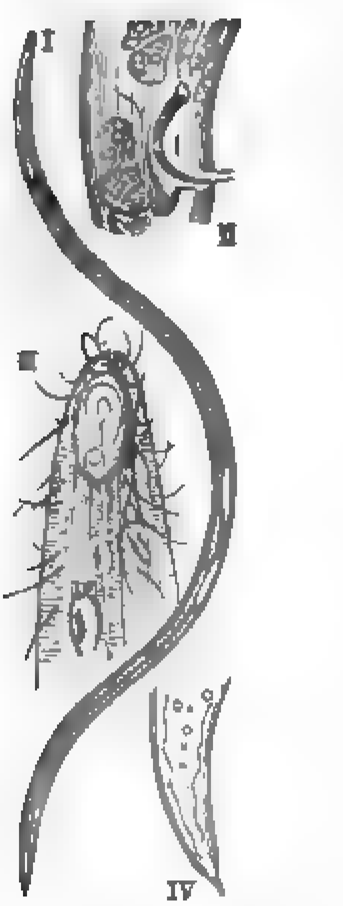


FIG. 9.—I. THE MALE OF DIPELTIS TYPICUS (×40); II, III, and IV, the anal region, head and tail end, respectively, of the same worm, more highly magnified (II, ×350; III, ×450; IV, ×350). I, shows, in the upper part, the œsophagus surrounded by the nerve-ring (white) and the unicellular excretory organ and its duct (both black); near the middle of the body the two (?) testicles (light).

as the latter is behind the head; it is two-thirds as wide as the body and fully twice as long as wide, and inasmuch as the porus is situated just behind the mouth (·7) empties its excretion through an unusually long duct. This duct ends in a distinct ampulla, which is connected with the exterior by the usual chitinous tube, here, however, of unusually great length.

$\frac{[illegible] \quad 7\cdot3 \quad 10\cdot \quad -M-[illegible] \quad 94\cdot}{\cdot8 \quad 1\cdot4 \quad 1\cdot6 \quad 2\cdot \quad 1\cdot6}$ 3· mm. This formula is based on the measurements of a single adult male. The tail is more strongly arcuate than that of the female. There are apparently two testicles arranged symmetrically, the anterior end of the foremost lying near the middle of the body. The ductus ejaculatorius is one-fourth as wide as the body, and is composed of two rows of cells. The two equal, strongly arcuate, linear, acute spicula compass an arc of 180°. Their proximæ are hardly cephaloid. They are somewhat longer than the anal diameter, and are supported in action by a single accessory piece one-half as long and furnished with a backward-pointing process.

IN CONFIRMATION OF THE GENUS *OWENIA* SO-CALLED.

By C. W. De Vis, M.A., Corr. Mem.

(Plate xiii.)

Some two years ago a few fossil bones were sent to me from the town of Warwick, Queensland. Unimportant in themselves they begot the hope that others would follow, but the hope proved futile, as no one on the spot was sufficiently interested in such matters to look for more. As it seemed important to ascertain whether the neighbourhood were indeed fossiliferous, Mr. H. Hurst was commissioned in August last to repair to the district and institute a careful search. This he did. The first fruits of an otherwise scanty ingathering were a Diprotodon skull in fragments, and the greater part of a large mandible in fairly sound condition. The latter at once met with a hearty recognition; its incisors and premolars were those of the genus to which the name *Owenia* had been assigned.

The discovery of a second species of the genus is opportune, inasmuch as it establishes a validity which has been denied, and offers for reconsideration a name which is undeniably liable to extinction. Suggested by a strong desire to commemorate, in even so feeble a fashion, the labours of the first interpreter of the marsupiate fossils of Australia, the name was proposed in spite of its declared preoccupation in sundry genera of recent invertebrates. The hope was cherished that since its appropriation to an extinct mammalian genus would cause little or no inconvenience, it might be allowed to pass current. But sentiment will evidently

not avail to excuse an offence against the letter of a law of nomenclature should an objector choose to exact the penalty. Consequently, the writer, brought to a sense of duty by a palæontological friend of well known judgment who happened to be in Brisbane when the fossil was received, now begs permission to withdraw the name *Owenia* and substitute for it the modification

EUOWENIA.

Characters :—Dentition $i\ \frac{3}{1},\ c\ \frac{0}{0},\ p^1\ \frac{1}{1},\ m\ \frac{4}{4}$.

Incisors conical, diverging, curving outwards and $\frac{\text{downwards}}{\text{upwards}}$, the lower receiving the upper upon and between them, the posterior upper incisor subrudimentary.

Premolars subtriangular, unilobate, with posterior talon and incomplete external cingulum. Molars of the normal form in the *Nototheriidæ*. Nasals narrow, short, not covering the narial aperture anteriorly. Jugals slender. Naso-frontal region as in *Nototherium* (nec *Zygomaturus*) and *Diprotodon*, not greatly depressed.

The almost complete reduction of the upper incisors to a single functionary pair, and the strong curvature of both upper and lower incisors are good generic characters.

The newly acquired mandible, for which a suitable name may be *Euowenia robusta*, indicates a species far removed from identity with *E. grata*, mihi. This will be best seen from the following statement.

Mandibular characters of the two species :—

Habit weak ; symphysial gradient steep ; inferior contour angular ; mesially rather concave ; incisors rotund.. ..... *grata*.
Habit robust ; symphysial gradient low ; inferior contour parabolic ; incisors compressed . . .. *robusta*.

The fossil consists of the inferior moiety of the articulating limb with the dentary limb of the left side in natural conjunction with the anterior half of the dentary limb of the right side, all the teeth of the parts preserved being in place except m^3 of the left side, which has been destroyed by a recent fracture of the jaw.

The mandible has been bequeathed by an individual well stricken in years.

The symphysis is 194 mm. in length; its upper surface descends caudad at an angle of 20°, in strong contrast with its precipitous descent in *E. grata*. Beneath the posterior end of the symphysis, on either side of its central line, is a deep excavation, confluent with its fellow posteriorly but separated from it anteriorly by a broad backwardly projecting spine, which gives a reniform shape to the excavation as a whole. The posterior half of the diastema is compressed; its edge ascends from the premolar forwards and about the middle of the diastema parts from that of the anterior half and curves downwards and forwards upon the outer surface of the incisive socket, but no tubercle is developed upon it as in *E. grata*. The anterior half of the diastema becomes less and less compressed as it approaches the incisive outlet. The dentary limb posteriorly is low, thick, and convex; at m^4 it has a height of 90 mm., with a thickness of 67 mm. Beneath the anterior grinders its outer surface becomes concave to a notable degree, but resumes its convexity in front of the anterior dental foramen, which is large and placed, as to its posterior margin, in the vertical of the anterior fang of the premolar. The articulating limb presents only the lower part of the masseteric fossa; this is, for a Nototheroid, rather deep, and has its surface corrugated by ridges and furrows which have a roughly concentric course near the base of the fossa, above it an irregular converging course towards the base. On the inner side the post-molar ledge behind the last molar rises into a strong abutment against the base of the tooth; this tapers off and subsides before reaching the angle of the ledge. The angle is well marked, and from it a broad low ridge runs upwards and backwards to the posterior dental foramen, which is large and is placed further from the angle of the ledge than this is from the last molar. The channel between the raised margin of the ledge and the coronoid process is contracted; the hinder surface of m^4 is level with the basal edge of the coronoid process. The inferior contour of the mandible would be a regular parabolic curve but for a slight emargination beneath the anterior dental foramen.

The large incisors are separated at the base by a space of 15 mm. They are in shape compressed twisted cones, diverging strongly outwards with a double curve which brings their trenchant apices nearly parallel with the axial line of the jaw. The surface of wear describes a convoluted curve from the middle of the outer upper edge to the inner face of the extreme tip and thence downwards upon the anterior surface of the tooth; the surface of wear is much larger on the right tooth than on the left. The apex of the tooth is unguiform, a shape conferred upon it by the coat of enamel investing the outer surface of the tooth.

The general shape of the premolar is triangular with the transverse and longitudinal diameters in the ratio 1 : 1·4. Wear has exposed an irregular field of dentine on the lobe and a larger one of crescentic shape on the talon; these are separated by their respective margins of enamel and these again by the remains of the depression which in the younger tooth separates the talon from the lobe. From the middle of the outer surface of the crown a projecting fold or cingulum runs along the posterior half to the end of the talon, the fore end of the crown is not reached by the worn surface above, showing that in the unworn tooth the lobe had a backward curve.

Of the molars there is little to be said; they present nothing which would compel us to distinguish the mandible from that of a *Nototherium*. The premolar and first molar of the right side are, like the incisors, much more reduced by attrition than those of the opposite side, and the greatest amount of reduction has taken place on the inner side of their crowns, a circumstance which reminds us of a somewhat similar condition of things in *E. grata*. In a large number of mandibles of *Nototherium* and *Diprotodon* a similar detrition of the inner sides of the anterior cheek-teeth does not once occur.

Dimensions.

Total length from tip of incisor to base of condylar process	450mm.
Height at m^4	90
Transverse diameter at m^4	67

Length of molar series with premolar	174
Length of premolar	14
Breadth of premolar	10
Length of m^4	48
Breadth of m^4	30
Length of incisor, upper edge	47
Breadth of incisor, longitudinal, at upper margin of outlet	34
Breadth of incisor, transverse	22
Length of symphysis	194

Judging by the general facies and by the molars only, and allowing for changes wrought by age and differences possibly contingent upon sex, the *Nototherium* jaw, with which the present one might readily be identified, is that named by Owen *Nototherium victoriæ.* So great is the resemblance between them that the writer long hesitated to think them distinct. Possibly they are not so, but after much pondering he has come to the conclusion that he would not be justified in assuming an identity for which, in the absence of the necessary tests, there is no positive warrant. Still it would be by no means surprising to find that the essential characters of *N. victoriæ*, at present unknown, associate it with *Euowenia.*

The family name *Nototheriidæ* has been imposed by the talented author of the British Museum Catalogue of Fossil Mammals, Vol. V., upon the single genus *Nototherium* as understood by Owen, and in a larger sense that name is admissible, nay inevitable. For the genus *Diprotodon* Mr. Lyddeker writes as a higher term *Diprotodontidæ.* This proposal to erect *Diprotodon* into the type of a distinct family must be ascribed to the unfortunate confusion perpetuated between *Nototherium* and *Zygomaturus.* Compared immediately with *Zygomaturus*, *Diprotodon* stands indeed sufficiently far aloof to be invested with family rank, but when *Nototherium* in its true characters is placed in position between the two, *Diprotodon* seems to be nothing more than a member of the *Nototheriidæ.* However that may be, the term *Diprotodontidæ* is

unfortunate, in fact altogether objectionable. In its exclusive sense it can only be properly applied to the wombats, in its looser signification it cannot be accepted as the name of a division of the *Diprotodontia* simply because it involves a contradiction; it inferentially secludes within the limits of a genus attributes which the term *Diprotodontia* predicates of the whole suborder to which the genus belongs. The infelicity of the selection of *Diprotodon* as a generic name would only be accentuated by raising a modification of it into the name of a higher generalisation.

The *Nothotheriidæ* include the genera *Nototherium*, *Diprotodon*, *Euowenia*, *Zygomaturus*, and probably *Sthenomerus*, but of the last named genus the dentition is insufficiently known. Probability is also in favour of *Scaparnodon* proving to belong to this family.

Characters of the Nototheriidæ.

Dentition $I\,\frac{3 \text{ or } 2}{1}$, $C\,\frac{0}{0}$, $P\,\frac{1}{1}$, $M\,\frac{4}{4}$.

Posterior upper incisors small. Premolars, except in *Zygomaturus*, subtriangular, single-cusped, with a posterior talon. Molars transversely bilobed, the upper without longitudinal ridges, talons antero posteriorly narrow. Scapula long, narrow. Ilia greatly expanded. Limbs gressorial, approximately equal; their proximal bones elongate, simple. Foot broad. Tail short, tapering.

Synopsis of genera :—

Incisors $\frac{3}{1}$—

Upper premolars subtriangular, unicuspid; cranial habit and length of muzzle moderate.

Crowns of first incisors contiguous or slightly diverging, the lower incisors proclivous.

Posterior upper incisors on the edge of the jaw; cusp of premolar with a shallow posterior cleft.................. *Nototherium.*

Posterior upper incisors near midline of jaw; cusp of premolar with a deep lateral cleft.............................. *Diprotodon.*

Upper premolars oval, tuberculated; cranial habit very massive, with short expanded muzzle.. *Zygomaturus.*

Incisors $\frac{2}{1}$—

Crowns of first incisors above and below widely diverging, with a similar strong double curvature.......................... *Euowenia.*

Supplementary Note:—In a collection of fossils received since the foregoing remarks were remitted, a second example of *E. robusta* very opportunely occurs. It exemplifies the state of the teeth and jaw at an early stage of adult life. At this period the following unessential differences are noticeable:—The corrugations of the ectocrotaphyte fossa are much less pronounced, the curvature, descending from the edge of the diastema, commences further forward, and the surface of wear on the incisor is not so extensive. In all other respects it is identical with the type. In the same collection is an isolated incisor and a fragment of jaw containing a premolar and first true molar, much worn.

NOTES AND EXHIBITS.

Mr. Maiden exhibited a number of vegetable products—fruits, seeds, gums, essential oils, and timbers—in illustration of his papers. Also specimens of a number of interesting indigenous (N.S.W.) plants including *Palmeria scandens*, F.v.M., from Bulli, *Callicarpa pedunculata*, R.Br., and *Alchornea ilicifolia*, F.v.M., from the Richmond River, *Telopea oreades*, F.v.M., and *Persoonia chamæpeuce*, Lh., from the southern portion of the colony.

Mr. T. W. Edgeworth David exhibited, on behalf of Mr. J. E. Carne, F.G.S., Mineralogist to the Department of Mines, Sydney, a specimen of precious opal from the White Cliffs about fifty miles northerly from Wilcannia. Precious opal and common opal have lately been discovered in this locality in a formation corresponding to the Desert Sandstone of Queensland. The opal occurs disseminated as an infiltrated cement throughout the mass of the sandstone in places, and also replacing the calcareous material of fossils. It also occurs in cracks in the sandstone and in fossil wood, which is somewhat plentifully distributed throughout the sandstone, and occasionally replaces part of the original woody tissues of the silicified trees.

Mr. A. Sidney Olliff stated that he had recently had an opportunity of examining a collection of *Coccinellidæ* gathered by Mr. A. M. Lea, among which he had found specimens of the lady-bird, *Vedalia cardinalis*, obtained at Mossman's Bay, near Sydney. This capture is interesting from the fact that the species has not previously been observed by our local collectors. Mr. Olliff also showed, under the microscope, specimens of larvæ and females of *Phylloxera vastatrix*, the vine pest, and he remarked that, so far, he had not yet been able to find either specimens of the leaf form of the pest, or reliable records of its having been observed in New South Wales.

Mr. Whitelegge exhibited a set of herbarium specimens of British species of the genus *Equisetum*. Also, under the microscope, specimens of the *Peridinium*, to the presence of which the recent discoloration of the waters of the harbour has been due; also specimens of several other species of allied organisms, including a second species of *Peridinium*, *Prorocentrum micans*, Ehr., *Gymnodinium spirale*, Bergh, and *Glenodinium* sp.

Dr. Cobb exhibited an inexpensive dissecting microscope of simple construction, made by one of the clerks in the Agricultural Department, Sydney. Also, under the microscope, examples of the Nematodes described in his paper. Also, two examples of fungi, one a species of *Phallus* from the adjoining garden, the other the bird's-nest fungus, *Cyathus*, from soil near a pumpkin vine; and coloured drawings of a number of other Australian fungi which he had recently met with.

Mr. Fletcher exhibited three specimens of terrestrial Nemertines (*Geonemertes* sp.)—one from the Richmond River, N.S.W. (collected by Mr. R. Helms), the others from Tasmania (collected by Mr. C. Hedley). The Tasmanian forms seem to differ in colour and pattern from the Victorian specimens recorded by Dr. Dendy and Professor Spencer, Mr. Hedley describing them while alive as "black at the oral extremity for about a quarter of an inch, the rest of the body dull white." The New South Wales specimen may, perhaps, belong to the same species as those noted by Dendy, the colour being brownish-orange, except for a lateral band on each side. If *G. chalicophora*, Graff, like *G. palaensis*, Semper, has six eyespots, in two groups of three each, then the specimens exhibited to-night, in which more than six eyespots are present, are not to be identified with the former, which is supposed to have been brought with palms from Australia to the palmhouse at Frankfurt Zoological Gardens.

Also, a male specimen of *Peripatus leuckarti*, Sang., (the only male out of a total of five specimens obtained on the Blue Mountains), which presents the exceptionally remarkable character of possessing a pair of papillæ—the only pair present,—on the ventral surface of the *first* pair of legs.

Also, fruits of *Sechium edule*, Swartz, a West Indian member of the natural order *Curcurbitaceæ*, which has been successfully acclimatised in Queensland for some years past. From a specimen forwarded from Queensland to Sir William Macleay a flourishing plant has been raised, which is now bearing freely in Sir William's garden, the specimen exhibited being from the plant in question.

Also, a living specimen of *Chiroleptes australis*, Gray, forwarded from Herberton, Queensland, by Mr. F. Christian. This species of frog inhabits the northern half of the continent, and has not been recorded on the east coast from further south than the Clarence River.

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WEDNESDAY, 27TH MAY, 1891.

The President, Professor Haswell, M.A., D.Sc., in the Chair.

Mr. A. Meston of Queensland was introduced as a visitor.

Mr. Fred Turner, F.R.H.S., Department of Agriculture, Sydney, The Right Rev. Dr. Camidge, Bishop of Bathurst, N.S.W., The Rev. J. G. Buggy, Kempsey, N.S.W., and Mr. C. A. Chesney, C.E., Randwick, were elected Members of the Society.

The Chairman called the attention of the meeting to a circular, copies of which were laid on the table, recently received from the Department of Agriculture of N.S.W., offering national prizes among other things for the best Australian Pathological, Entomological, and Botanical collections submitted to the Department.

DONATIONS.

"Transactions of the Canadian Institute." Vol. i., No. 1. *From the Society.*

"Bulletin of the Museum of Comparative Zoology at Harvard College." Vol. xx., No. 8 (Jan., 1891). *From the Curator.*

"Annales de la Société Entomologique de France." 6e Série, T. ix. (1889). *From the Society.*

"Bulletin de la Société d'Etudes Scientifiques d'Angers." Nouvelle Série, T. xviii. (1888). *From the Society.*

"Bulletin de la Société Zoologique de France pour l'Année 1891." T. xvi., Nos. 1 and 2. *From the Society.*

"Bulletin de la Société Royale de Géographie d'Anvers." T. xv., 2^{me} Fasc. *From the Society.*

"Mémoires du Comité Géologique, St. Pétersbourg." Vol. iv., No. 2, Vol. v., Nos. 1 and 5, Vol. viii., No. 2, Vol. x., No. 1 (1890); "Bulletins." Vol. ix., Nos. 7 and 8 (1890). *De la part du Comité.*

"Transactions of the Cambridge Philosophical Society." Vol. xv., Part 1; "Proceedings." Vol. vii., Part 3 (1890). *From the Society.*

"Zoological Society of London.—Abstracts," March 17, and April 7, 1891. *From the Society.*

"Bulletin de la Société Impériale des Naturalistes de Moscou." Année 1890, No. 3; "Beilage zum Bulletin." ii^{me} Série, T. iv. (1890). *From the Society.*

"Transactions of the Entomological Society of London for 1891." Part i. *From the Society.*

"The Victorian Naturalist." Vol. viii., No. 1. (May, 1891). *From the Field Naturalists' Club of Victoria.*

"Twenty-seventh Annual Report of the Zoological and Acclimatisation Society of Victoria (1890)." *From the Society.*

"Transactions of the Victorian Branch of the Royal Geographical Society of Australasia." Vol. viii., Part 2 (March, 1891). *From C. Hedley, Esq., F.L.S.*

"Proceedings and Transactions of the Queensland Branch of the Royal Geographical Society of Australasia." Vol. vi., Part 1 (1890-91). *From the Society.*

"Department of Agriculture, Brisbane.—Bulletin." No. 8 (Feb., 1891). *From the Under-Secretary.*

Pamphlet entitled "Comparative Methods of Digestion, Circulation, and Respiration in Fishes, Amphibia, and Mammals." By J. B. Wilson, M.A., F.L.S. *From the Author.*

"Bulletin de la Société Linnéene de Normandie." 4^{e} Série, Vol. iii. (1888-89). *From the Society.*

"Journal of the Asiatic Society of Bengal." Vol. lii. (1883), Part ii., Title-page, &c., and Pl. i., ix., and x.; "Proceedings, 1891." No. 1 (January); "Annual Address to the Society" (Feb., 1891). *From the Society.*

Pamphlet entitled "Descriptions of two new Butterflies and nine Hawk-moths (Sphingidæ) found in Queensland." By Dr. T. P. Lucas. *From the Author.*

"President's Address delivered to the Royal Society of N.S.W." (May 6, 1891). By A. Leibius, Ph.D., M.A., F.C.S. *From the Author.*

"Zoologischer Anzeiger." xiv. Jahrg., No. 360 (6th April, 1891). *From the Editor.*

"New Zealand Journal of Science." Vol. i. (n.s.), No. 3 (May, 1891). *From the Publishers.*

"Australasian Journal of Pharmacy." Vol. vi., No. 65 (May, 1891). *From the Editor.*

"Proceedings of the United States National Museum." Vol. xiii., Nos. 829-833 and 838 (1891). *From the Museum.*

"United States Department of Agriculture—Division of Entomology. Bulletin." No. 7 (1890); "Insect Life." Vol. iii., No. 6 (March, 1891). *From the Secretary of Agriculture.*

"Bulletin of the American Museum of Natural History." Vol. iii., pp. 195-210. *From the Museum.*

"Annual Report and Prospectus of the Stawell School of Mines, 1891." *From the Director.*

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PAPERS READ.

A CONTRIBUTION TO THE GEOLOGY AND PETROGRAPHY OF BATHURST, NEW SOUTH WALES.

By J. Milne Curran, F.G.S.

(Plates xiv.-xviii.)

CONTENTS.

I.—Introduction.
II.—Area dealt with.
III.—Previous observers.
IV.—General Geology.
V.—Formations represented.
VI.—Minerals of Bathurst.
VII.—Rocks of Bathurst.

A. Igneous Rocks ...	Plutonic—Acidic. Volcanic—Basic.
B. Sedimentary Rocks	Arenaceous. Argillaceous. Calcareous.
C. Altered Rocks ...	Hornfels. Schists. Knotenschiefer.

VIII.—The Sedimentary Rocks.
IX.—The Igneous Rocks.

Granite	a. In the field. b. Origin of. c. Microscopic examination. d. Chemical composition.
Basalt	a. In the field. b. Microscopic examination. c. Chemical composition.

X.—Economic Geology
XI.—Other points of interest.
XII.—Conclusion.

i. Introduction.

The material embodied in the following paper, is the result of observations, made at intervals, during the last ten years. A residence of some eight years in Bathurst gave me special facilities to study the geology of the district. During that time I have carefully examined some 180 square miles of country, taking the City of Bathurst as a centre. Although I am conscious the paper deals with nothing that may be regarded by geologists as novel or striking, for all that, it may be acceptable to place on record my observations on a district on which very little has hitherto been written. The present contribution will, I hope, be merely an introduction to the geology of a portion of the country that presents rare facilities for the study of many of the great questions connected with the nature of metamorphism, and the phenomena presented by altered strata in the regions of eruptive rocks.

The hand-specimens which accompany this paper will help to make clear descriptions of rocks of uncertain affinities. The micro-photographs of rock-slices, on Plate xiv., will also help to illustrate the structure of the basalts. This is all the more useful in the present unsettled state of petrological nomenclature. As there is a growing tendency among petrologists to follow Professor Rosenbusch's classification of the eruptive rocks, I have, as far as possible, referred the Bathurst rocks to his system.

There are many interesting questions immediately connected with the geology of Bathurst not touched on in this paper. The contact area, for instance, that forms a fringe of metamorphic rock around the central boss of granite, would demand more knowledge and experience in the refinements of modern petrographic methods than I can lay claim to. In fact I have studiously avoided, or merely pointed out, debatable questions. But, having described what almost all geologists are agreed on, the way is clear in the future to deal with the more obscure, but possibly the more interesting, problems that may be studied in and around Bathurst. In dealing with the microscopic structure of the basalts

and granites I have received much kind assistance from our leading petrologist—A. W. Howitt, Esq., F.G.S., now Under Secretary for Mines, Melbourne.

ii. Area dealt with.

I propose to deal with the geology of the country immediately around Bathurst. Every reference contained in this paper deals with localities or sections that are included in a circle having a radius of ten miles, taking Bathurst as a centre. A few interesting features outside these limits will be referred to when presenting points of interest known to me. These may serve as a guide to future students.

The stretch of country forming, for the most part, the well-known Bathurst "plains" is, in reality, part of a plateau, on an average about 2350 feet above sea level. Bathurst Railway Station is 2153 feet above sea level, and the highest point of the Bald Hills is some 630 feet above this datum. The extreme difference in level between any two points in the district referred to may be taken as 740 feet.

iii. Previous Observers.

The first reference I can find to the geology of Bathurst is contained in Captain Wilkes' "Narrative of the United States Exploring Expedition," Vol. II. p. 259.* In this work reference is merely made to the fact that the plains of Bathurst were at no distant date an inland lake.

Mr. Stutchbury, who was appointed Geological Surveyor in 1850, made frequent reference to the Bathurst district in his reports to the Colonial Secretary. The only reference of his to the country immediately around the City of Bathurst that I can find is contained in a report, dated "Belabula Rivulet, Carcoar, County Bathurst, April 12th, 1851."

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* Narrative of the United States Exploring Expedition during the years 1838-1842, by Charles Wilkes, Commander; Philadelphia, 1842.

Speaking of the country on the Western Road, between Junction Hill and Bathurst, he says,* "The rounded blocks, which when free upon the surface, appear to be immense boulders, or erratic blocks, are not such, but large glandular or globular masses, often connected by veins, and evidently intruded subsequently; these may be seen in many places in the road-side sections, imbedded in coarse granite, traversed by quartz veins in all directions.

"The foot of the hill is composed of disintegrated granite, forming a loose sand. About one mile east of the river the granite is overlaid by clay slate, 'killas.' Granite, with fragmentary trap-rock, appears to form the whole of the country to Macquarie and Bathurst plains; the plains are alluvium, and, judging from the debris in the water-runs, most probably investing granite.

"Lead mines were reported as occurring at Brucedale, near Peel, about eight miles from Bathurst, a little eastward of north, the residence of Mr. W. Suttor; the road then contains much micaceous sand and quartz pebbles.

"On descending the last hill, about two miles from the house, blocks of decomposing granite are occasionally observed; upon crossing the creek it is found, in place upon a ridge running nearly east and west, associated with mica slate, much disturbed, passing into clay slate; the dip of the clay slate is west north west.

"To the eastward of south, half a mile from Mr. Suttor's house, a mine has been opened, in which the following varieties of ore have been found:—

"Sulphuret of lead, with arsenical pyrites.
"Green phosphate of lead, in veins in the clay slate.
"Arsenio-phosphate of lead, and
"Argentiferous sulphuret of lead.

"The cross lodes make their way west north west through clay slate, the angle of dip being 50°.

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* Geological Survey Papers, laid upon the Council Table by the Colonial Secretary and ordered by the Council to be printed; 2nd December, 1851.

"The mines, as at present exhibited, do not promise to be remunerative; the ore appears to be sporadic rather than in regular lodes.

"On the eastern side of the creek there are numerous fragments of grit stone, containing impressions and casts of Spirifiræ, evidently belonging to the coal measure; these must have been transported some distance."

In a paper by the Rev. W. B. Clarke on the Transmutation of Rocks in Australasia, read to the Philosophical Society of New South Wales in May, 1865, mention is made of metamorphic rocks near Bathurst. Says Mr. Clarke, "One of the most remarkable changes I have ever noticed in the neighbourhood of granite occurs a little south of Bathurst. . . slates are converted into mica schist and griesen, and limestone is changed into saccharoidal marble."*

In 1867, the Rev. W. B. Clarke, M.A., F.R.S., published the first edition of his "Sedimentary Formations." He refers to the "existence of gneissoid strata and of schists, of very ancient aspect, at Cow Flat, near Bathurst."†

In his annual report for the year 1878, Mr. C. S. Wilkinson, F.G.S., Government Geologist, refers as follows to the geology of Bathurst:—"Immediately north of the village of Perth, near Bathurst, are some table-topped hills—the Bald Hills—capped with basalt. The basalt rests on a very siliceous, tertiary pebble conglomerate, which, in turn, rests on granite. . . . I believe that this basalt is an outlier, or remnant, of the basaltic stream which, in pliocene times, flowed down the Campbell's River valley from near Swatchfield. The basalt is, in places, columnar, and on the Bald Hills this columnar structure is splendidly shown, the

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* Trans. Phil. Soc. New South Wales, 1862-1865; Sydney, Reading and Wellbank, 1866, p. 267.

† Remarks on the Sedimentary Formations of New South Wales, by Rev. W. B. Clarke, M.A., F.R.S. (fourth edition); Sydney, Thomas Richards, Government Printer, 1878.

five and six-sided columns being of considerable length and well formed; sometimes they are curved in a remarkable manner."*

In the annual report of the geological surveyor in charge†, for the year 1879 (p. 214), we find Mr. Wilkinson again making a short reference to Bathurst as follows:—"Following the road from Bathurst to Hill End the first eight miles is over granite, then silurian schists to Wyagdon, then granite again for one mile and a half to near Wattle Flat."

The Department of Mines issued a volume in 1882, entitled "Mineral Products of New South Wales." On p. 39 of this work, Mr. Wilkinson says:—"Near Bathurst upper silurian rocks have been considerably metamorphosed, the sandstones passing into quartzites, slates into gneiss and hornblendic schists, and the coralline limestone into crystalline marbles in which nearly every trace of fossils has been obliterated."

Finally, Mr. W. J. Clunies Ross, B Sc., read a paper, before the Melbourne meeting of the Australian Association, on the Plutonic and Metamorphic Rocks of Bathurst, New South Wales. Up to the date of writing it has not appeared in print, so that I am unable to refer to the paper in a more detailed manner.

iv. General Geology.

Taking a general view of the district round Bathurst, we have presented to us a central mass of granite, forming the floor, and partly the sides, of a great valley. Higher up the sides silurian rocks rest on the granite. On the floor of this valley a great sheet of recent alluvium shingle and clay deposit is spread, and through these latter deposits the Macquarie has eroded its present bed. A chain of basalt-capped hills rises prominently above the granite floor, forming a line generally parallel to the present river.

* Annual Report of the Department of Mines, New South Wales, for the year 1878; Sydney, the Government Printer, 1879.

† Annual Report of the Department of Mines, New South Wales, for the year 1879, Sydney, the Government Printer, 1880.

An aureole of altered rocks separates the granite from the silurian slates, phyllites or limestones. In short, we have a great saucer-like depression, the edges of which are silurian rocks; below these there is a belt of hornfels, or metamorphic rocks, and, finally, granite with recent superficial deposits fills the floor of the valley.

Through this valley, as stated already, rising abruptly from the general level, there runs a line of basalt, burying an old river-bed of pliocene age. The granite, from its first appearance to the east, to the boundary of the silurian rocks on the Bathurst-Orange Road, measures some thirty miles across. From the contact rocks on the Winburndale Creek, to the junction of the slate and granite, south of Bathurst, the distance is some eighteen miles, that is 540 square miles. But, allowing for a very irregular line of junction and the small patches of basalt, I take the granite area to measure, at a very moderate estimate, about 460 square miles.

In this area the lowest rocks—granites and hornfels—are the more recent, as will be made clear in another section of this paper.

Surface Geology.

This granite country presents a surface of gently undulating hills and ridges with broad valleys. Except in cuttings in creeks, or on the river-banks, the granite hardly ever shows on the surface, and when it does it is so decomposed as to disintegrate readily and rapidly. As is usual with granite, the decay commences in the felspar grains, thus setting free the other constituents—quartz, hornblende, and biotite. The depth to which decomposition extends varies much; sometimes to a few feet, and sometimes, in cases that came under my notice, to a depth of 70 feet. The "rolling downs" character of the granite country contrasts strongly with the surface appearances of the surrounding slate. The hills in the slate country show the bed rock freely in escarpments and bars parallel to the strike. The vegetation, moreover, assumes a noticeable change on passing from the granite to the slate country. The accompanying photographs show in an admirable way the difference in weathering in granite and in slate country. Fig. 1

shows the channel of the Macquarie in typical granite rocks. A short distance down stream (Fig. 2) the river passes into silurian slates, dipping at a high angle. The same sharp contrast extends through the country, as a whole, and may be studied to advantage in the hills about Cow Flat to the south of Bathurst, and in the Winburndale Creek, some seven miles to the north of the same town. Immediately round Bathurst the granite is overlain by detrital deposits, varying in age from pliocene to the most recent, or now in process of formation. This applies especially to the strip of country, including that on which Bathurst stands, between the chain of the Bald Hills and the Macquarie River. Deep water-courses have cut through these deposits, exposing beds of alluvium from two to fifteen feet in thickness, or decomposed granite in some instances to a depth of thirty feet. That these erosions have been effected rapidly, that is within the past fifty years, can be readily proved. Some of the old settlers recollect a time when many of these creeks were shallow water channels. Roots of, comparatively speaking, young trees may oftentimes be seen stretching from one wall of these gullies to the opposite one, showing that the very beginning of the erosion must have taken place at a time when the trees were fairly grown. It is impossible not to be struck with the resemblance, in miniature, that some of these creeks with their vertical walls bear to the cañons of Colorado. The photographs exhibited, taken about one and a half miles to the south-west, illustrate these features very clearly. The exact locality lies between the racecourse and the slopes of the Bald Hills. The oldest of these detrital deposits are, undoubtedly, those that flank the Bald Hills, and the more recent are those that form terraces to the present river. Further on we shall see that the line of basalt that crowns the ridges of the Bald Hills marks the course of the one-time bed of the Macquarie. From the time it occupied this position, the river has, at various intervals eroded channels over the whole country between the Bald Hills and the opposite slopes of the valley. In this way are accounted for, the beds of shingle, gravel, and detrital matter that conceal the granite. Large deposits of shingle and water-worn

material, marking the position of ancient river beds, may be studied at Kelso, near the Railway Gates; near the Church of England grounds; on the slopes to the right of Kelso-Peel Road, about two miles from Kelso; on the gravel-topped hills between All Saints' College and the General Cemetery; near St. Stanislaus College, and generally on the ridges between the Vale Creek and the Macquarie.

V. TABLE OF FORMATIONS REPRESENTED AROUND BATHURST.

POST TERTIARY.	MOST RECENT OR NOW IN PROCESS OF FORMING ...	A. Deposits of loam, clay, sand, gravels and decomposed granites.
UPPER TERTIARY.	POST PLIOCENE	B. Gravels and shingle beds, at various levels, between the basalt and the present river bed.
	VOLCANIC...	C. Basalt flow, capping hills.
	PLIOCENE	D. Clays, sand, gravels, and conglomerates forming "leads" under basalt.
	LOWER PLIOCENE ...	E. Silicified conglomerates older than "leads."
MESOZOIC ROCKS.—Not represented.		
PALÆOZOIC.	IGNEOUS AND METAMORPHIC	F. Granites.
		G. Hornfels rock, gneissic schists, spotted schists, mica schists and marbles.
	SILURIAN	H. Clay slates, phyllites, limestones.

vi. Minerals of Bathurst

Before dealing with the formations and the rocks in detail, it may be well to enumerate the minerals and rocks I have found in the district.

Minerals.

1. Calcite.
2. Apatite.
3. Quartz.
4. Garnet.
5. Olivine.
6. Topaz.
7. Prehnite.
8. Felspar.
   a. Orthoclase.
   b. Plagioclase, Oligoclase.
   c. Albite.
9. Augite.
10. Hornblende.
11. Actinolite.
12. Muscovite.
13. Biotite.
14. Kaolin.
15. Sphene.
16. Galena.
17. Green phosphate of lead.
18. Arsenio-phosphate of lead.
19. Limonite.
20. Mispickel.
21. Pyrites (iron).
22. Magnetite.
23. Copper (native).
24. Malachite.
25. Copper pyrites.
26. Grey ore.
27. Azurite.
28. Argentiferous galena.
29. Gold.
30. Diamond.
31. Manganese (black oxide).

Note.—The following are also reported from Glanmire:—Rhodonite (Annual Report Dept. Mines, N.S.W., 1885, p. 141), manganese ores, and baryta (Annual Report Dept. Mines, N.S.W., 1884, p. 161).

1. *Calcite.*—Calcite is found in veins in the limestones on the Cow Flat Road, about four miles south of the village of Perth. It also forms veins in fissures in the granite. This seems an unusual occurrence, and only two instances came under my notice. It was rather plentiful in a joint or fissure, cut through in the large well of the water-works, Bathurst. There is little doubt but that it is a secondary mineral, formed from the decomposition of some lime felspar.

2. *Apatite.*—Apatite occurs as microscopic needle-shaped bodies in the quartz and felspar crystals of granite. It is very conspicuous in some slices.

3. *Quartz.*—Quartz is very abundant in the district, and is found as veins in the slate rocks adjoining the granite, from a few inches up to some feet in thickness. It may be easily studied in the slate hills about Peel, eleven miles north of Bathurst, and over the country five miles south of Perth. There are large quantities of water-worn quartz on the various terraces that the river has left in eroding its way from the level of the Bald Hills to it present bed. It is almost unnecessary to refer to it as a constituent of the granite. In fine, a very pure form of silica is found, as silicified wood, in drifts that have been denuded of a covering of basalt.

4. *Garnet.*—Garnet, the exact species not determined, occurs in the river sand, and when sand or gravel is washed for gold some garnets are always found. It occurs also as inclusions in the felspars of the granite.

5. *Olivine.*—This mineral is only known as a constituent of the basalt; it rarely attains macroscopic dimensions, but under the microscope it is found in crystals, relatively so large as to give the basalt a micro-porphyritic structure; this is well shown in the rock-slices, Plate XIV. In polished slabs of basalt it can be detected as specks, somewhat darker than the matrix, and easily acted on by warm hydrochloric acid. Infusible before the blowpipe; completely soluble in hydrochloric acid; olive-green in colour; colourless by transmitted light.

6. *Topaz.*—Commonly found with the gem sand washed from the alluvial deposits in searching for gold. I have only met with small stones.

7. *Prehnite.*—A pale green to almost colourless and translucent mineral was found, associated with calcite, filling a fissure in partly decomposed granite at the water-works. I am indebted for my specimen to Mr. W. J. Clunies Ross, B.Sc. It answered as follows to the tests applied—*Streak:* colourless, *Hardness:* 6,

Fracture: even but brittle. Heated in the closed tube, gave off a little water. Dissolves completely in hydrochloric acid. Contains silica, alumina and lime; proportions not determined. Before the blow-pipe intumesces to a porous mass. This mineral I take to be prehnite.

8. *Felspar.*—Orthoclase occurs as a leading constituent in the Bathurst granite. Near White Rock, and other places, it occurs in a porphyritic granite as crystals from half an inch to two inches long. Under the microscope it is more cloudy than plagioclase, which sometimes accompanies it. In most old rocks, when examined in thin slices, orthoclase usually appears more or less impure, on account of foreign substances and cleavage planes that exist in it. In this respect Bathurst orthoclase follows the general rule. No analysis of this mineral has been made, so far as I am aware; but from the intense colours, afforded by Szabo's methods, I am inclined to think the percentage of potash is high. Typical orthoclase contains silica 64·6, alumina 18·5, potash 16·9.

Plagioclase.—It is rare to find a thin section of Bathurst granite entirely free from plagioclase, but there is no predominance of this mineral anywhere in the district over the monoclinic felspar, by which the granites might pass locally into quartz diorites. About four years ago I sent some slices to Mr. A. W. Howitt, then of Sale, and he determined that the triclinic felspar of the Bathurst granite was, in all probability, oligoclase. Triclinic felspars, as one should certainly expect, are abundantly developed as microscopic lath-shaped bodies in the basaltic rocks. Any slice of the Bathurst basalt will show this clearly. See Pl. xiv.

Albite.—Mr. Howitt detected this felspar in some micro-slices I submitted to him in 1886 It occurred as minute veins in orthoclase, placed approximately in the direction of the ortho axis.

9. *Augite.*—This monoclinic pyroxene is known only as a micro-porphyritic constituent of the basalts. Sections, approximately parallel to the clinopinacoid, are readily obtainable. It also occurs as minute grains in the ground mass of the basalts. Its

abundance in this relation can be ascertained by treating a rock-slice with acid so as to separate the soluble olivine and magnetite.

10. *Hornblende.*—Is found as a macroscopic mineral in the granite ; crystals vary in size, the largest I have noticed measuring from one-sixteenth to one-eighth of an inch along the vertical axis.

11. *Actinolite.*—Found to the south of Bathurst, forming veins in quartz. Most of my specimens come from Cow Flat. It formed fibrous, radiated masses of dark green colour, easily fusible before the blow-pipe. After fusion it becomes strongly magnetic. Specific gravity 3·5.

12. *Muscovite.*—Muscovite, or common mica, is found as an accessory mineral in the Bathurst granites. Towards the edges of the granite mass it often entirely replaces the black mica so characteristic of the typical Bathurst granite. Muscovite occurs in considerable quantities in the river sands. When fresh it is usually colourless, when slightly decomposed it appears as a rich yellow, and an opaque golden hue is very common. It also is found in the sands of almost every creek in the district.

13. *Biotite.*—Black, magnesia, iron mica occurs as small, partly formed crystals and scales, disseminated through the granite, but occasionally, particularly near the edges of the granite rocks, large plates can be detected. By transmitted light it sometimes appears of a deep green colour. After long heating it decomposes in sulphuric acid. Fusible without much difficulty. Plates, corresponding to basal sections, are easily picked out in decomposing granites. The dark colour of the granite is due to the exceedingly large proportion it contains of biotite and hornblende.

14. *Kaolin.*—Kaolin, of various degrees of purity, can be found both as decomposed granite *in situ*, and in small beds of transported material. A pure white kaolin was found on the Bald Hills, a little to the right of the line of section A B marked on the map. When washed free from particles of quartz it formed a tolerably pure kaolin, but the percentage of iron was too high for a marketable article.

15. *Sphene.*—The sands, resulting from the decomposition of the granites, are full of magnetic ironstone and titaniferous iron. This material is so plentiful that after floods it will be found deposited as black sand in the creeks to the south of Bathurst and about Kelso. Mr. A. W. Howitt first drew my attention to it in the micro rock-slices. I have since detected wedge-shaped crystals, of a deep brown colour showing dark borders with transmitted light, in slices of granite from near Mt. Stewart. The titaniferous ironsand may be collected in large quantities by passing a magnet through the dry sand in any of the creeks within the granite area. In this sand I have frequently detected titanium by fusing the mineral with bisulphate of potash until decomposed. The fused mass is then warmed in water in just sufficient quantity to dissolve the soluble material. A few drops of nitric acid are added to the filtrate, and the latter diluted with six or seven times its bulk of water and boiled. Titanic acid separates as a white powder. The powder can be further tested before the blow-pipe in a bead of microcosmic salt.

16. *Galena.*—Is known to occur in veins and lodes in connection with quartz reefs. So far as observed, it is unknown in granite rocks, but is found at, or near, the junction of the slate and granite, both to the north and south of the granite formation. A typical occurrence of this mineral may be studied near the residence of Mr. Suttor at Mt. Grosvenor, Peel. As has been found in other parts of the world, the galena here contains variable amounts of silver. It is not found in such large quantities as to make it profitable as a lead ore. The silver assays are always low, the highest not exceeding 20 oz. per ton of ore.

17. *Phosphate of Lead.*—Occurs sparingly as an incrustation on decomposed galena ore on the Grosvenor Estate, near Peel. I have never detected the arsenical variety of this mineral referred to by Mr. Stutchbury, *ante* p. 176.

19. *Limonite.*—Limonite is found as veins filling cracks or joints in the granite. It is clearly in these instances a secondary

product. It is met with in the excavations at the water-works, and also in a tunnel driven to test the wash in the Bald Hills. Thin layers of this mineral may sometimes be noticed in dried-up water-holes, near the decomposed basalts in the Bald Hills. Clayey ironstones are also found as a cementing material, binding quartz pebbles together, forming post-pliocene river drifts. Peculiar pea-shaped concretions of ironstone are often met with in deposits formed from decomposing basalts.

20. *Mispickel.*—Arsenio-pyrites or mispickel is tolerably abundant in the schistose and slate country along the southern granitic boundary. It occurs both massive and crystallized. This mineral was found in a well, associated with iron pyrites, on Mr. Butler's selection near Green Swamp, on the Kelso-Rockley Road.

21. *Iron pyrites.*—Is very plentiful in the slate country about Bathurst. A very notable occurrence was discovered in a shaft put down by Mr. J. Wilde on Butler's farm, to the south of Perth. The crystals were mostly cubes, and formed the greater part of the rock. Microscopic crystals of pyrites are very common in some of the slates about Cow Flat. I have also noticed yellow iron pyrites in micro-slices of granite from a railway cutting beyond George's Plains; also in slices of the same rock from the base of Mount Pleasant. It can easily be recognised in microscopic sections by reflected light, the bright yellow of the pyrites being clearly seen.

22. *Magnetite.*—This is only known as a microscopic constituent of basalt. It will be referred to, in detail, in dealing with the microscopic structure of the basalts.

23-28. *Copper Minerals.*—It has been already remarked that the metalliferous minerals are confined to the zone of contact rocks. It is in these rocks that native copper, malachite, copper pyrites, grey ore, and azurite have been discovered. I have found native copper in hornfels rock at Duramana, on Kelly's farm. Malachite occurs sparingly at Cow Flat, south of Bathurst. In the specimens I examined it seemed to result from some alteration of azurite or blue carbonate of copper. In keeping with this fact

I have often noticed fibrous green malachite as pseudomorphs after azurite at the Cobar copper mines. Grey copper ore is recorded, on good authority, as occurring in the Cow Flat copper mines. These mines are now closed.

29. *Gold.*—Gold is found in the drifts of the Macquarie, and, more or less abundantly in the shingle beds forming river terraces back to the pliocene "leads." The fact that gold is found in water courses cutting through decomposed granite rocks, such as in those creeks on the common near Bathurst, is thought by some to prove that the gold has been shed from a granitic matrix. While admitting that, in some instances, gold may be derived from a granitic rock,* yet, in our case, it is unnecessary to fall back on any such supposition. I venture to account for the presence of the alluvial gold in this way. The Bald Hills are some 600 feet above the Bathurst Plains. On their summits there rests a layer of basalts covering pliocene drift. This drift has been proved by tunnelling to carry gold. At some points the basalt and underlying drift have been entirely removed by denudations, while along their whole length the margins of the drift have been eroded. The detrital matter, with its auriferous deposit thus obtained, has been spread out between the hills and the river, during all that period that the river has been cutting its way from its old position to its present level. The gold now obtainable in the granite creeks is, in fact, a re-distributed pliocene lead. The character of the gold confirms this theory. It is not possible to distinguish the gold washed from the creeks from some flakes found in the highest drifts. In the creeks referred to the precious metal was never found in quantities sufficient to pay for its recovery.

30. *Diamonds.*—Although I have not seen a diamond from any of the drifts round Bathurst, it may be well to refer to the fact

* For an interesting article on gold in granite, see Clarke's "Southern Gold fields: Researches in the Southern Gold-fields of New South Wales, by the Rev. W. B. Clarke, M.A., F.G.S.;" Sydney, Reading & Wellbank, 1860.

that the Rev. W. B. Clarke records four diamonds as coming from the bed of the Macquarie, near Suttor's Bar. None have been discovered of late years.

vii. Rocks of Bathurst.

In enumerating the rocks of Bathurst, I think it well to define the terms used in describing the igneous rocks. It makes little matter what system of nomenclature one follows, provided always that the terms are clearly understood. Throughout this paper the rock names will be made use of in the sense here indicated.

ROCKS OF BATHURST.

Igneous Division.

A. *Plutonic Acidic Rocks.*

1. Amphibole granite.
2. Granulite.
3. Aplite.
4. Graphic granite.
5. Greisen.
6. Porphyritic granite.
7. Felsite.

B. *Volcanic Basic Rocks.*

Basalt.

Sedimentary Rocks.

A. *Argillaceous.*

1. Clays.
2. Slate.

B. *Arenaceous.*

1. Sands.
2. Sandstone.
3. Conglomerate.

C. *Calcareous.*

Limestone.

Altered Rocks.

1. Hornfels.
2. Schists.
3. Nodular schists.

vii. Igneous Division.

A. *Plutonic Acidic Rocks.*

1. *Amphibole granite.*—A crystalline, granular rock, composed of quartz + orthoclase + plagioclase + hornblende.* This corresponds to the granulite à amphibole of Fouque and Lévy. These authors, in the splendid work just referred to, define granulite as consisting of black mica, oligoclase, orthoclase, quartz and hornblende. Granulite à amphibole merely differs from this rock in the total or partial substitution of hornblende for black mica.†

2. *Granitite.*—A crystalline, granular rock, consisting of quartz + orthoclase + plagioclase + magnesian mica. This agrees with granitite of Fouque and Lévy.

3. *Aplite.*—A granular compound of potash felspar (orthoclase or microcline) and quartz, with muscovite mica as an accessory.

4. *Graphic granite.*—This variety of aplite, in which the quartz laminæ form figures bearing a fancied resemblance to Hebrew letters, is sometimes found as water-worn fragments about Poor Man's Hollow and at Perth.

5. *Greisen.*—Thin veins of a rock, composed of quartz and mica, may be found near the boundaries of the granite and slate country.

6. *Porphyritic granite.*—In very many parts of the district the felspar crystals of the granite are so large and well-developed, being frequently two and three inches in length, as to entitle the rock to be called porphyritic granite.

7. *Felsite.*—An intimate, granular-crystalline admixture of orthoclase and quartz. Common in the drifts.

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* Rosenbusch, Mikroskopische Physiographie der Massigen Gesteine, p. 29; Zweite Auflage.

† Minéralogie Micro-graphique Roches Eruptives Françaises, pp. 156, 160.

B. *Volcanic Basic Rocks.*

Basalt.—An intimate dark blue or black compound of augite, labradorite and olivine, with some glassy matter. Magnetite and ilmenite are generally present as well. The Bathurst basalt is micro-porphyritic in structure, and, according to Möhl's classification, our rock is a plagioclase basalt. Boricky would call it a felspar-basalt. Rosenbusch makes basalt include all neo-volcanic rocks of basic composition, which essentially contain plagioclase and augite. Olivine, this author does not consider as an essential constituent. As regards structure, this basalt falls under Division 4 in Rosenbusch's classification, and is, therefore, termed hypo-crystalline porphyritic.*

VII. Sedimentary Rocks.

Argillaceous Rocks.

1. *Clays.*—Composed of hydrous silicate of alumina. The Bathurst clays contain mixtures of sand and iron oxides in various proportions.

2. *Slate.*—Indurated clay, sometimes fissile in planes forming an angle with the bedding, but more often fissile in the direction of the bedding.

Arenaceous Group.

1. *Sand.*—Chemical composition, silica. Mineral components, quartz or flint. Beds of sand are common in many of the more recent formations.

2. *Sandstone.*—The shingle of the drifts consists of siliceous sandstones to a very great extent; pure quartz and felspar pebbles, however, predominate.

3 *Conglomerates.*—This rock consists of rounded pebbles of quartz, sandstone, slate and jasperoid rock, cemented either by siliceous or ferruginous matter. As stated on p. 181, we have two conglomerates, similar in composition but different in age, near Bathurst.

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* Rosenbusch, Mikroskopische Physiographie der Massigen Gesteine, p. 728; Zweite Auflage.

Calcareous Rocks.

Limestones.—Chemical composition, carbonate of lime. Some of the crystalline limestones, of a clear white colour, from Cow Flat, are good examples of this rock. At the limekilns, some 18 miles north of Bathurst, there are very considerable beds of limestone. Some are white, but, in most instances, they are blue or grey, from the fact that the last remnants of organic life have not been destroyed.

Altered Rocks.

1. *Hornfels.*—A black or bluish-black rock, close-grained and heavy, with blebs of a milk-blue quartz. In hand specimens this rock might be taken for a fine-grained gneiss or an altered schist. Study of the rock, *in situ*, shows it in every variety, from massive and holo-crystalline to schistose.

2. *Nodular Schist* (Knotenschiefer).—Schists in which small, rounded concretions are present, and which stand out like knots on the planes of foliation. Splendid examples of this rock may be found in a creek by the roadside on the Bathurst-Peel Road. The exact locality is at a point where a small bridge or culvert on the main road crosses a tributary of the Winburndale Creek, near the foot of a steep hill, about 7 miles from Bathurst.

3. *Schistose Rocks.*—The schistose rocks about Bathurst might be described as clay slates in which layers of mica have been developed and exhibiting distinct foliation. A typical mica schist is an aggregate of quartz and mica only. Hand specimens can be found about Bathurst that cannot readily be distinguished from typical mica schists. But, as a rule, the rocks that I have noticed might be described as felspathic, mica schists, in fact a transition rock, or a variety between the normal type and a gneissic schist. They are abundantly developed about Cow Flat and in the country round the upper Winburndale Rivulet to the north-west of Bathurst.

VIII. Sedimentary Formations.

Upper Silurian.—The slates, gneissic schists, and limestones near Bathurst, have been regarded by all our geologists as of

upper silurian age.* The lithological characters of the rocks suggest, almost at first sight, that the slates and limestones are similar in age to well known silurian formations. Very few fossils have been discovered, and all those that have been described point to the same conclusion. De Koninck mentions *Stromatopora striatella*† from the Limekilns 16 miles north of Bathurst. Recently I have collected specimens of the same fossil from the same place. De Koninck also mentions *Favosites fibrosa* from this locality.‡ A short time ago I noticed well preserved examples of the silurian coral, *Phillipsastræa*, near the Benglen Caves Limekilns. Mr. Etheridge, jun., palæontologist to the Australian Museum, to whom I submitted my specimens, informed me that the Phillipsastraea is a new species.§ The fossil evidence stands thus :—

	COLLECTED BY.	IDENTIFIED BY.
Petraia sp.	Suttor. ...	Mines Department.‖
Stromatopora striatella ...	Clarke. Curran. ...	De Koninck.
Favosites fibrosa	Clarke. Curran. ...	De Koninck.
Phillipsastræa sp. ...	Curran. ...	Etheridge, jun.

* Wilkinson, Notes on the Geology of N. S. Wales, p. 39 of Mineral Products of N. S. Wales; Sydney, Government Printer, 1882.

† Recherches sur les Fossiles Paléozoïques de La Nouvelle-Galles du Sud, p. 10.

‡ Fossiles Paléozoïques, p. 22.

§ Mr. Etheridge considers the *Phillipsastræa* a new species. He proposes to describe it at an early date as *P. Currani*. Regarding this coral, he writes, under date 12th February, 1891 :—" *Phillipsastræa*.—This is a very interesting coral and does not appear to be identical with any of the European or American species, so far as the works of reference at my disposal will enable me to judge. *P. Currani* is peculiar in the absence of all trace of a columellarian tubercle, and the central area or calici being entirely tabulate-vesicular, on to which the septa do not pass. De Koninck records *P. Verneuilii*, Ed. & H., as a New South Wales species, but speaks, in his description, of the corallum as composed of superimposed layers, and possessing a thin columella. Neither of these features are present in your specimen."

‖ Annual Report of the Department of Mines, New South Wales, for the year 1881, Appendix H. p. 148; Sydney, Government Printer, 1882.

These are silurian in type. There can be no question that the fossiliferous limestones are interbedded with the phyllites and slates; so the whole formation may be unhesitatingly accepted as silurian in age. There is still additional evidence pointing in the same direction. Resting unconformably on the slates are to be found in places a series of sandstones and grits containing the well known brachiopods *Spirifer disjunctus* and *Rhynchonella pleurodon*. These Devonian rocks are in turn overlaid by carboniferous beds. These successions can be studied well by examining the country to the east of the Bathurst-Limekilns Road, on the upper reaches of the Winburndale, and generally, from the spurs of the Winburndale Mountains, in the same neighbourhood, across to the Limekilns. To sum up, we have evidence from the fossils enumerated, as well as stratigraphical and lithological proofs, of the position of the slate formations in the geological series

When one approaches Bathurst, from any side, it will be noticed that as the granite region is approached the slates show signs of disturbance. They become more fissile in character, and faults are frequently developed. Contorted strata, principally slate, are to be seen in every creek or favourable cutting. Good examples of this occur about Peel, and an exceptionally good contorted section is exposed in a road cutting on the right of George's Plains and Cow Flat Road. Travelling still towards the granite, glistening plates of mica become apparent on splitting the rock, showing a new phase of crystallization. Further on, the mica becomes more plentiful, so much so as to be recognisable as alternating layers along which the rock easily cleaves. While still nearer the granite the now schistose rock exhibits a peculiar puckered and wavy surface with a satiny sheen. Then dark spots make their appearance, and knots, ovoid and round, stand out on the weathered planes. These spots vary in size from a pin's head to a pea. In this we have an excellent example of the interesting metamorphic slate known as Knotenschiefer. Finally, a mass of rock is met with of a dark blue colour, with no traces of schistosity in any direction, forming a typical hornfels. This interesting succession of zones

[redacted]

of contact metamorphism can be followed in a line due north from Mr. Coombe's residence, Glanmire. Spotted schists and hornfels can be followed by travelling up the creek (a tributary of the Winburndale) from the culvert referred to on p. 192. The hornfels will be found exposed between the head of the creek and the road. Hornfels rock, in many interesting varieties, can be collected too at Duramana, where it is used for road purposes. Good outcrops of the same rock are easily accessible in a road cutting on the Orange Road, near the "Rocks," as well as on the Rockley Road, south of Perth, and on the Blayney Road, near the granite boundary.

The aureole of metamorphic rock around the granite may be divided into three zones, but, from the very nature of the case, it is evident that no hard and fast line can be drawn between these belts. The zones may be distinguished as—

1. Zone of micaceous clay slate.
2. Zone of knotted slate, often mica slate (Knotenglimmerschiefer).
3. Zone of hornfels rock.

It will of course be understood that these zones of rock do not follow each other in due succession at every point. That this should be so would suppose denudation to have excavated the river valley equally on all sides—a manifest impossibility. As a matter of fact knotted and altered slates may be found at times nearer the central granite mass than hornfels rock. But this difficulty is easily explained by assuming an underlying mass of granite not yet exposed, or by noticing that sometimes the granite dips away under the slate rock at a low angle and further on comes once more to the surface.

Relative Age of the Sedimentary Rocks.—Silurian slate is the oldest rock around Bathurst. At first sight this may seem rather puzzling. The position and structure of these slates show them to be sedimentary in origin. But we have abundant proof that they were laid down, consolidated, and crushed into great folds long before the granite was erupted. Of course we might suppose the

granite to be the result of extreme metamorphism, as possibly some granites are, but in studying the geology of Bathurst one soon abandons all hope of maintaining such an origin for the granitic mass as a whole. This will be dealt with further on.

Wherever I have studied good junctions I always noticed that the slates are cut off suddenly by the granite, and in no instance have I ever seen a slate rock resting on a granitic floor in a way that would suggest it was *originally laid down there*. Indeed, no idea can now be formed of what may have been the character of the old sea-bed on which the sediments were first deposited No trace or vestige of it remains. The granite behaves in every respect as a rock that was erupted into overlying slates, and is, therefore, the newer. Slate, then, we take to be the most ancient formation. Next in age come the granites. The overlying Devonian rocks are, of course, more recent than either.

From the character of the material forming the great bulk of the slates, we can surmise that the rocks were formed on a deep sea-bottom. The margins of any sea-bed would naturally be made up of coarser material. Rocks, corresponding to these deposits, are abundantly represented. The lines of limestone had an origin not unlike the coral reefs of our own day. The proximity of limestone to conglomerates points to the presence of a shallow sea or sea beach. The old silurian ocean had its lines of coast, and there must have been a continent at no great distance off, the wearing down of which supplied the material to form the rocks we are discussing. In what direction did this continent lie? What was the nature of its rocks? Has it disappeared to its very foundations? These are questions, full of interest as they are to the geologist, to which no satisfactory replies can be given.

The only formations resting on the granites and slates are the drifts. These are all of tertiary and post-tertiary age. Between these two widely separated formations there exists an immense interval, regarding which the rocks of Bathurst contribute nothing to our knowledge. It is difficult to think that no other rocks, Devonian, Carboniferous, or Jurassic, ever existed above where

Bathurst now stands. Evidence is accumulating to show that the Devonian rocks, found both to the east and west of Bathurst, once formed a great anticlinal fold over the granite. This, probably, formed an island in Carboniferous and Jurassic seas. But all direct proof is missing and practically nothing is known of the physical surroundings of this district from Devonian to Jurassic times. The most tenable opinion is that we had dry land hereabouts when the Carboniferous formations to the north and west were being deposited. This means that rivers from Bathurst mountains flowed into Carboniferous and probably Mesozoic seas, and that our hills were old when many parts of Europe and Asia were still under water.

The drifts referred to are all alluvial, marine deposits being quite unknown. Every drift about Bathurst owes its origin to the present river. The oldest deposit is some 540 feet above the present bed, so that the amount of eroded matter is very considerable. By joining the basalt hills marked F, A, H, K, on the accompanying map (Pl. XVIII.), the bed of the old pliocene river may be approximately traced. These basalt hills were, there is no doubt, once continuous, and the gaps now present are the result of subaërial denudation. The history of the changes, since the days when the Macquarie flowed through this channel nearly 600 feet above its present level, is shortly this. The river was the main drainage line of the country, therefore, the lowest depression within the water-shed. Active volcanoes were pouring out floods of lava about Swatchfield and Orange. One of these streams of liquid rock flowed down and filled up the valley of the Macquarie. The river waters were thus displaced and forced to erode for themselves a new channel. The granite proved more yielding than the compact basalt, so that while the basalt remains the granite has been subjected to every agent of denudation. In effecting this we can with much reason suppose the river to have been a far greater stream that it is now. Volcanic eruptions are always attended with atmospheric disturbance and heavy rains; moreover, the rainfall was undoubtedly greater. Then the rock was, in all

probability, suffering from *la maladie du granite* so noticeable now.*

A glance at section i, Pl. XVI. will show some of the various positions of the river from its oldest bed to its present course. The remnants of old channels on the slopes between the river and the Bald Hills vary in age. The oldest drift we know to be Pliocene. The newest is now forming, and the most we can do is to point out that the drifts cover intervals from the Pliocene to this day.

IX. Igneous Rocks.

Granite—In the field.—There is no lack of outcrops of granite, even within the limits of the sketch map appended. Wherever the granites show on the surface they are decomposed. This is so constant a character that it may be taken for granted that the whole surface of the granite is undergoing rapid decomposition, as stated in a former part of this paper. In sinking wells, ten and twenty feet of decomposed rock are frequently met with. All along the river valley wherever the rock crops out it is invariably decomposed. Indeed, Bathurst affords a good instance of the sickening of granite referred to by Dolomieu. Even when the minerals of the rock hold firmly together, their slices, cut from surface specimens, show cloudy felspars and incipient kaolinization. For microscopical purposes the best locality to procure chips for micro-slices is at the waterworks, where a deep shaft has been put down, and among the broken boulders on the northern slopes of Mt. Pleasant.

Granite is exposed up the river to O'Connell's Plains, and along the railway line to Locksley. Between Locksley and Brewongle some interesting junctions may be noted, one in particular at a bridge crossing the line between the two stations. Following the

* The disintegration of granite is a striking feature of large districts in Auvergne, especially in the neighbourhood of Clermont. This decay was called by Dolomieu "la maladie du granite." The phenomenon may, without doubt, be ascribed to the continual disengagement of carbonic acid gas from numerous fissures. Lyell's Principles of Geology, 11th edition, Vol. I. p. 409.

line west, good junctions of the Silurian rock and granite can be seen a little to the Bathurst side of Newbridge Station. Decomposed granite is exposed in a cutting on the river bank at the foot of George Street, near the railway gates, Kelso, near the rifle butts, at Rankin's Bridge, in the railway cuttings between Bathurst and Brewongle, and in almost any of the creeks on the slopes of the Bald Hills. Following the river down, junctions of slate and granite rocks will be found in the neighbourhood of the "Forge," some sixteen miles from Bathurst. The change from the granite to the slate country is very marked in this vicinity. The granite rocks are worn into smooth boulders, reminding one of the *roches moutonnées* produced by ice action, while the slate shows jutting points and pinnacles that conform more or less to the strike of the slate. Boulders of a hard, undecomposed granite are to be found on the railway line beyond Wimbledon. Porphyritic granite is common, but limited in quantity, in each locality. There are some good specimens near the river crossing on the road to White Rock.

A rather noticeable feature in the Bathurst granite is the inclusions that are by no means rare. These vary from a few inches to many yards in length. The prevailing tint of the granite is a light bluish-grey. The inclusions are always dark coloured. When examined minutely they are found to consist of the same material as the body of the granite in a finer state of division. These inclusions contain a considerable amount of titanic or magnetic iron. When the rock is powdered a magnet will separate it readily. If the Bathurst granite is of metamorphic origin, then the inclusions may represent fragments of the original parent rock that have withstood metamorphism. On the other hand, they might represent fragments of slate caught up by the molten granite. After studying a great many of these inclusions, I find it hard to believe that they are the result of any chemical or selective influences in the cooling mass. I rather incline to the view that they are mechanical. Some of the inclusions consist entirely of black mica, felspar and quartz. There is no sharp line separating the one from the other.

In weathering, the granite gives rise to a rather poor and barren soil. Fortunately, soils resulting from either granites or sandstones are seldom found alone. Everywhere there is spread about a certain amount of alluvium from the old river beds. And over large tracts traces of a rich soil, resulting from the decomposition of basalts, can be detected.

Origin of the Granite.—There is a growing belief in the metamorphic origin of many granites. The Bathurst granite, being limited in extent and easily accessible to its boundaries, presented special facilities to study its origin. It is now a common position for geologists to hold that, although in many and perhaps most instances, granite is an intrusive rock of plutonic origin, yet granites do occur which are the result of extreme metamorphism. Examples are eagerly sought for to show that granite can be produced by the metamorphism of sedimentary materials *in situ.*

At the very outset I may state that although I am tolerably familiar with the line of junction between the slates and granites, I have never met with one instance of a gradual change by which granite could be said to melt away on all sides into the surrounding strata, or in which an undoubted granite shades off, by gradations, into a rock of clastic origin. In studying the origin of the granite, the boundaries and junction lines will naturally afford interesting material. Are these boundaries marked by a hard and fast line? Does the granite mass behave like an eruptive rock? Does it alter the rocks it touches? Does it thrust dykes and veins into the rocks around, or do the many square miles of granite melt away, by insensible gradations, into slates and phyllites?

Wherever I have observed contacts, the line of junction has been hard and fast. The granite does thrust out veins into the slates near it, and, without doubt, it alters clay slates to hornfels. The granite is, therefore, in a sense intrusive, but this does not exclude the view that it may have been, for all that, derived from pre-existing sediments. I will now describe a few instances that will maintain my position as to the intrusive nature of the granite, and then consider the probabilities of its being derived from pre-existing sedimentaries.

A junction of granites and Silurian rock can be well seen near the bridge over the Winburndale Creek, on the Bathurst-Peel Road, a few hundred yards up stream. Two rocks are noticeable, one of flesh-coloured granite, which is very marked in its contrast with the other, a massive, compact, bluish rock—a hornfels or altered slate. The granite is mainly binary with strings and nests of translucent quartz. There are occasional flakes of black mica, and layers of white mica are sometimes developed along the joints. The flesh-coloured porphyritic granite sends veins of varying thickness into the hornfels. One vein, not above an inch in thickness, is shot in a right line into the altered slate for fully 20 yards; see Pl. xv. fig. 5.

In the same locality I noticed a granitic vein springing from the main mass of granite and entering the hornfels as a dyke about a foot thick. A short distance away it is narrowed down to five inches, at the same time bending round to form a right angle with the first direction and then continuing in a right line in its new course. Smaller veins connect the two arms at the angle. A diagram of this interesting intrusion will be found on Pl. xv. fig. 6.

A little further along the same road, in the direction of Bathurst, a tributary of the Winburndale is crossed. It is dry at most seasons of the year. By following up this creek, a variety of rocks will be met with, indicating that the junction of the slate and granite is not far off. Near the culvert, in fact under it, splendid samples of "spotted slate" can be found with a general strike to the north-west.

I will narrate, in the order they are met with, some of the varieties of rocks that may be studied here, following the creek up from the road.

1. Some three hundred yards from the culvert there is a vein of felspathic rock, containing blebs of translucent quartz, silvery mica, and quartz veins. This is some three feet in thickness, and contains inclusions of a schistose hornfels.

2. Slate, dipping north-east at a high angle.

3. A granitic dyke, with inclusions of a schistose hornfels. The general direction conforms to that of the slate. It consists of felspar, quartz and white mica. Besides the mica distributed through the rock, there occur nests of the same mineral, oftentimes with the mica contorted and broken.

4. Spotted slate, with occasional thin veins of quartz.

5. A dyke of granite, with large felspars and white mica. There are layers of white mica on every joint.

6. Slate.

7. Coarse granite, with parallel jointings.

8. Spotted slate.

9. Granite vein, some six yards wide, in places almost as fine-grained as a felsite. The rock is rendered porphyritic in places by nests of silvery mica and felspar. There are also thin veins of quartz.

10. A thick belt of spotted slate, nearly two hundred yards wide, with occasional thin veins of quartz.

11. A vein of granite, with black mica.

So far, although we are approaching the main granitic mass, neither black mica nor hornblende has yet been developed.

12. Boulders of porphyritic granite, with dark fine-grained inclusions.

13. Beyond these last named rocks there are few exposures of the bed rock, but some hundred yards further on the typical Bathurst granite is met with, containing both hornblende and black mica.

The succession here detailed points out that the actual junction between the older and newer rocks is a wavy line with sharp and deep bends. In one place the granite runs into the slate in dykes and veins, while between these there are left jutting points and arms of the old rock standing between walls of granite. Junctions of a similar nature are described by Mr A. W. Howitt in his able paper on the Diorites and Granites of Swift's Creek.*

* Transactions of the Royal Society of Victoria, Vol. XVI. pp. 11-87.

Near Newbridge, the junction of the igneous and sedimentary rocks presents the same features. In a cutting on the Bathurst side of the railway station bars of igneous and slate rocks can be studied in actual contact. The boundary-line between the two is still sharp, and no evidence can be found of a slate merging into a granite. On the contrary, examples can be found where the intrusion of the granite in a liquid or pasty condition, but evidently under great pressure, has bent and crushed, and pushed on one side, the easily yielding slates. In cases where the granite does alter the rock with which it is in contact, the alteration consists in the development of a rock not in any way resembling a granite. Where the alteration is most complete, a hornfels is the result, and where incipient alteration is noticeable, a close examination reveals merely a rearrangement of old minerals and the introduction of only one new one. Between Locksley and Brewongle, on the railway line, a good example is exposed of the alteration produced by the intrusion of granite. Near a high level bridge, between these two stations, a mass of granite will be found lying partly to one side and partly under a micaceous and schistose rock. The granite sends veins into the overlying beds. This upper rock, as stated, is of a schistose character, and it will be noticed that the planes of schistosity are parallel to the mass of the intrusive rock. In this instance the schistose planes are horizontal, which gives the rock a bedded appearance. But in other parts of the district, notably on the Rockley Road, south of Peel, where a foliated or schistose structure is developed, the foliation planes are vertical. This inclines one to the view that an envelope of foliated rock once surrounded the granite mass, so that when a portion of the original sediments remain *above* the granite the schistose structure will be horizontal, but when they are seen forming a vertical boundary to the intruded granite the planes of schistosity will be vertical. In connection with this peculiar structural development, it may be mentioned that a schistose structure can be induced in wax and mixtures of oxide of iron and pipeclay by pressure,* and that, in these instances, the

* See Tyndall's "Fragments of Science," Vol. I. p. 366.

planes of the laminæ are found to arrange themselves in rudely parallel planes perpendicular to the lines of pressure. Whatever may be the explanation, we have here at Bathurst a foliated or schistose structure developed in sedimentary rocks when in contact with an intrusive granite. When a fragment of these ancient sediments is found above, and resting on, the granite, the foliated structure lies horizontally, and when found adjoining the granite mass, the folia stand vertically. A diagram showing the intrusive veins at Locksley will be found on Pl. xv. fig. 1. The sketches were made some eight years ago, when the face of the cutting was fresh. I examined the same section a few months ago, and although the rocks have disintegrated a little and vegetation is beginning to take hold there, the intrusive veins can be easily studied.

With the evidence of these sections before us, we are now in a position to enquire into the origin of the granite. Everything that we know points to the one conclusion, that the Bathurst granite is intrusive. The granite alters rocks with which it comes in contact. It sends tongues, veins and dykes into the adjoining rocks. Nowhere can we trace a gradual change from a sediment to a rock granitic in structure. The proximity of granite has converted phyllites into hornfels. It has caused a rearrangement of old minerals in the sedimentary strata, and caused the development of one new mineral in abundance, namely, mica. But this is all. Nothing approaching a granite can be found resulting from any metamorphic process, and in no one section have I ever discovered anything like a change from a clastic to a holo-crystalline rock, granitic in composition.

When I first examined the rocks around Bathurst the prevailing impression left on my mind was that the granite melted away by insensible gradations into the surrounding rocks. A more minute examination rendered this position untenable; but it will be interesting if we can yet discover a granite truly metamorphic in origin. There can be no difficulty, as far as chemical composition of some slates goes, in believing that the constituents of a slate

rock may be rearranged so as to give rise to a rock that may not be distinguished from granite. The evidence advanced in support of the metamorphic origin of many granites broke down when the rocks were subjected to the test of microscopical examination. But there are still cases where all the refinements of modern geology have been employed without shaking the conclusion that some granites, at least, and certainly some crystalline schists, can be produced by the metamorphism of rocks *in situ.**

There is little doubt, then, but that the granite was intruded into Silurian rocks after their folding and elevation. Possibly the granitic intrusion formed an anticlinal, and lifted the sediments yet higher. Silurian rocks once occupied the place now taken by the granite. Were the former rocks simply lifted or thrust aside, or were they absorbed by the molten or plastic granite? Lifted, I should say. There is little proof to show in support of this view, but it is an impression left after a study of the whole district. I have no doubt at all but that portions of the Silurian rocks were absorbed by the granite in its intrusion. When we examine the outer edges of the granite, we find that for a short distance from the contact it differs from the typical rock. There is, for instance, an absence of hornblende, the mica is in nests, and the minerals, generally, are not arranged as in a normal granite. Quartz, instead of filling up the spaces left by the other constituents, is found in grains and blebs through a much larger body of felspar. All this might be accounted for by the more rapid cooling of the margins of any intrusive rock. But I consider it as the result of the absorption of a certain amount of the pre-existing phyllites.

In this connection I would like to draw attention to some views on the origin of crystalline rocks as set forth in the volume of the International Geological Congress for 1888.†

In a paper on the "Archæan Geology of the Region N.W. of Lake Superior," Dr. A. C. Lawson points out that the archæan

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* See Green's "Physical Geography," Chapter IX., second edition.

† Congrès Géologique International 4me Session —Londres, 1888. Etudes sur les Schistes Cristallins.

rocks of that region can be resolved into two great divisions. The lower composed of rocks which but for their foliation are regarded as of plutonic igneous origin. Resting on these is a mass of stratiform rocks, partly detrital, partly volcanic. These latter, or upper series, were certainly not laid down on the lower. The old floor on which they were deposited has disappeared; and again, Dr. Lawson points out that the lower series could not have been the crust from which the detritus for forming the upper rocks was derived.

"There is but one way of reconciling these statements. It is a simple conception, and one well in accordance with established geological truth, that certain portions of the earth's crust upon which strata are accumulating may sink gradually. Now, that portion of it upon which the upper archean was accumulating, to a thickness of several miles, may be conceived to have been depressed, either by reason of the superincumbent weight or from other causes, till it came within a zone of a sort of fusion compatible with the conditions of such depths. This fusion gives us the magma which is implied in the conception of the laurentian gneisses, granites, and syenites, being of plutonic igneous origin."*

Vancouver Island furnishes another example that may throw some light on the origin of the Bathurst granite. Dr. G. M. Dawson has described the relations of granites to triassic beds in Vancouver and the adjacent coasts. Triassic beds are frequently found in contact with, or resting upon, granite rocks. They were not, however, deposited on a granitic floor, as the granites are evidently of a later date. "The circumstances attending the line of junction of the granites with the rocks of the Vancouver (triassic) series have been carefully examined at a great number of points. The granites near this line are usually charged with innumerable darker fragments of the Vancouver series, which, when in the immediate vicinity of the parent rock, are angular and clearly marked, but at a greater distance become rounded and blurred in outline, and might then be mistaken for concretionary

* Congrès Geologique International, Londres, 1889; pp. 75, 76.

masses in the granite, into the substance of which they have been in process of being absorbed. The width of the belt characterized by these fragments is very variable, and where the plane of the present surface cuts that of the junction of the two classes of rocks at an acute angle—as is often the case—it is considerable, frequently exceeding half a mile. . . . The only explanation which appears to satisfactorily account for the appearances met with, is, that we have at the surface a plane which was at one time so deeply buried in the earth's crust that the rocks beneath it had become subject to granitic fusion or alteration."*

The bearing of these extracts on the geology of Bathurst is obvious. Here we have Silurian rocks resting on a granite. There must have been a solid floor on which they were deposited. The granite on which they rest was certainly not the pre-existing basement. And it is extremely improbable that granitic rocks formed the crust from which the sediments were derived. Thus far the conditions are very similar; and it is hard to resist the conclusion that when the original floor of the Silurian was being absorbed in the granitic magma, some of the Silurian rocks suffered a like fate.

The Devonian and Carboniferous formations are now estimated, by Mr. C. S. Wilkinson,† to measure 20,000 feet in thickness. With two miles of strata resting on our Silurian rocks, we can see the possibility of the lowest series being brought within a zone of fusion, which would furnish the required magma, and make the Bathurst granite, in a sense, at once metamorphic and intrusive.

We have abundant proof, as shown above, that the granite is intrusive in character. It is quite another question to decide whether the material that forms the granite was drawn from a deep-seated source, or whether it is the result of the profound metamorphism of a previously existing sediment.

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* Annual Report of the Geological Survey of Canada, 1887; Report B., pp. 11-13.

† See "Notes on the Geology of New South Wales," by C. S. Wilkinson, F.G.S., contained in "Mineral Products of New South Wales;" Sydney, the Government Printer, 1887.

I am not in possession at the present time of sufficient material to deal with this question, but, as a first step towards a solution of the problem, I may state that there is abundant reason for believing that the granite exposed about Bathurst is but a small portion of a very large mass that underlies the palæozoic rocks on all sides. In keeping with this view, we find that the granite is exposed for a much greater distance up and down the river than across the valley. The lowest rock for miles around is probably granite, and the Bathurst rock shows merely where the overlying beds have been denuded.

Microscopic Examination of the Granite.—I have made some twenty-five slices of the granite for microscopic examination. Nearly all the minerals of the rock can be seen macroscopically, particularly in polished specimens. Certainly there are fine-grained varieties, but the average Bathurst granite is coarse-grained. Crystals of black hornblende are not unusual of 9 mm. in length. Glistening faces of felspars, 16 mm. long, are frequently found. In polished specimens the silica and felspars appear in about equal quantity, or perhaps with felspars slightly in excess. The minerals proved to be present by a microscopic examination are:—

Essential Minerals.	*Accessory Minerals.*
Quartz.	Muscovite.
Felspar.	Apatite.
Hornblende.	Sphene.
Biotite.	Garnet.
Magnetite.	Calcite.

Quartz.—Under the microscope, in plain parallel light, the quartz is easily distinguished from all other minerals by its water-clear appearance, the absence of inclusions, and its fresh, unaltered aspect. It is found filling up the spaces left by the other constituents. Under higher powers, inclusions will be noticed, but not in such quantity as to lessen the contrast between the clear quartz and the cloudy felspars. The hair-like lines that cut through the quartz in every direction fall under the heading of trichites, described by various observers. These trichites can be noticed

striking in every direction through the clear quartz. A power of one hundred diameters shows them in great abundance. They branch, sometimes meet at a point, fifteen or twenty diverge from one point, and sometimes opaque blebs are found at various points along their length, or, more often, at the end. I can offer no explanation as to their real nature. Cavities are abundant in the quartz. They can be detected in every slice. I have noticed one spontaneously moving bubble. Besides the trichites and bubbles, tubes can be seen in the silica with a power of fifty diameters. They are evidently tracks left in the plastic mass by moving bubbles of gas.

Examined in polarized light, with crossed Nicols, the quartz displays the usual gorgeous broad sheets and bands of colour, one colour imperceptibly shading into another. In very thin slices it appears a dull blue-grey. The great abundance of cavities in the silica of all the slices is explained by the fact that the quartz was the last mineral to crystallize. When rocks that have cooled from an igneous magma are studied, it is often noted, as we should expect, that the most fusible mineral was the last to crystallize. But it is found that this does not apply to granitic rocks. Every student knows that quartz is commonly called infusible, while the felspars are considered fusible in various degrees. In the consolidation of granite from an igneous fluid or paste, felspar was the first to crystallize, while the more infusible quartz filled up the interspaces and was the last to solidify. Our granite is no exception to the rule, for the silica occurs in an amorphous state, enclosing the other minerals as in all true granites. This is explained by supposing that the original plasticity was induced in some other way than by what we understand as dry igneous fusion. The fluid inclusions prove the presence of water and various salts. The quartz, being the last to harden, took in any fluid residue and, from its enduring nature, retained it. A notable feature of the quartzes, under the microscope, is the presence of microscopic dust which seems to have accumulated on the outside surfaces of the quartz granules.

The proportion in which the minerals occur, as revealed by the microscope, may be expressed as follows, felspar being the commonest :—1. Orthoclase ; 2. Silica ; 3. Triclinic felspars ; 4. Biotite ; 5. Hornblende ; 6. Magnetite ; 7. White mica.

Felspars.—With crossed Nicols, the felspars can be readily divided into orthoclase and into felspars with distinct triclinic striations. The orthoclase occurs in sub-crystalline patches, and, in most slides, is the more plentiful of the two. In its general appearance the orthoclase is always cloudy, even in the thinnest sections. The cloudiness and opacity of the orthoclase is a constant character in all the slices I have cut. I attribute this peculiar dimness to pores and fractures that no doubt hasten incipient kaolinization. This structure has, no doubt, a great deal to do with the "sickening of the rock" before referred to. Indeed, anyone accustomed to micro-petrographical work, would, on account of these characters, at once decide that the rock was not of an enduring character.

Triclinic Felspars.—The banded appearance, so characteristic of the triclinic felspars, is at once noticeable under crossed Nicols in every slice. The amount of plagioclase relative to the orthoclase varies much. The plagioclase is often in excess, and sometimes the two felspars seem equal in quantity. I sent a few slices of this rock to Mr. A. W. Howitt, our leading Australian petrologist, and he decided, from the structure of the crystals and from their obscuration angles, that the felspar was oligoclase. Sections are not uncommon with the fine bands of colour crossing at an angle of 90°. This felspar contains inclusions of other minerals that had crystallized before itself. Magnetite is a common inclusion, as well as corroded crystals and plates of hornblende.

Hornblende.—Every slice will show hornblende more or less plentifully under the microscope. The crystals are generally much corroded, showing that they were formed long before the felspars. A few examples show the exact prismatic hornblende. Most of the sections, however, are in zones other than the prismatic, and show only one set of cleavage lines. In thin sections it appears

of a deep brown colour, and sometimes of a rich sap green. Nearly every slice has a favourable section on which the angle, formed by an axis of elasticity and a crystallographic axis, can be measured. Sometimes it is not easy to distinguish between hornblende and biotite in slices of the Bathurst granite. For the information of students who may make use of these notes, I may just indicate the difference. The micas, including of course biotite, show no sensible dichroism in sections parallel to the base. In sections across the cleavage the biotites will show very strong dichroism on rotating the lower Nicol prism. Hornblende is also dichroic, but a few sections can usually be found on the slice parallel, or nearly parallel, to the base; these will show two sets of cleavage. Sections of hornblende, parallel to the vertical axis, show but one set of cleavage lines, and in this resemble mica. But the cleavage planes of the hornblende are generally coarse, or seldom so close as those in mica. Mica, too, has usually a more ragged look than hornblende, and the ends of the laminæ have a frayed-out appearance. Finally, unless the section be cut exactly parallel to the orthopinacoid, hornblende does not extinguish when the cleavage lines are parallel to a diagonal of the Nicols. Between crossed Nicol prisms all sections of biotite will be black when the cleavage corresponds with the plane of vibration of either Nicol, since the cleavage corresponds with an axis of elasticity. With hornblende this is not the case, and, in the larger number of its sections, the point of maximum darkness will be obtained when the cleavage makes a certain, though not great, angle with the plane of the light.

Biotite.—Biotite is common in all the slices. It appears as irregular plates, with parallel striæ, corresponding to the cleavage on sections, parallel to the vertical axis. The absorption exhibited by rotating the polarizing prism under the section is very marked. Sometimes flakes show of a light brown colour, without any cleavage lines, exhibiting no dichroism. These I take to be biotites cut parallel to the basal planes or cleavage. They resemble, in every respect, flakes or plates cleaved from biotites and mounted separately for comparison.

Muscovite.—Muscovite is, comparatively speaking, rare. Mr. A. W. Howitt first pointed out its presence to me. It is common enough in the aplite and kindred rocks on the borders of the granite country. But in the main body of the granite it has been, up to the present, detected only under the microscope.

Magnetite is readily recognised in every slice by its remaining opaque in the thinnest sections, and by its peculiar lustre in reflected light. Sphene is another rare constituent. It appears in clear brownish-red granules. Sometimes wedge-shaped crystals can be seen with dark or almost opaque edges.

I have selected four fairly typical slides from my rock slices, and I will give a short description of their microscopic characters.

1. (Slice 48). The general appearance of this slice under the miscroscope is that of a holo-crystalline rock. Some of the micas and hornblende show crystalline faces, but the quartz and felspars are, for the most part, allotriomorphic. With crossed Nicols, a considerable quantity of plagioclase becomes visible, but it is altogether subordinate in amount to the orthoclase The quartz occurs in broad plates, filling up the interspaces between the other minerals, and showing in polarized light the customary brilliant colours. Glass cavities and fluid cavities are very abundant in the quartz. Fluid cavities, with bubbles of gas, can be readily found with a magnifying power of about seventy five diameters. By using $\frac{1}{8}$ immersion lens, cavities containing spontaneously moving bubbles can be detected. The Bathurst granite affords abundant material for studying this wonderful phenomenon. The slide I am describing contains many good examples of spontaneously moving bubbles. Some of these bubbles move round the cavities slowly, reminding one of the movements of a rotifer in search of food Others are stationary until the slice is slightly heated, when the bubbles are seized with a sort of trembling motion and suddenly start off travelling round the cavity. I have noticed many in which the movements are so rapid that it is difficult for the eye to follow them in their course. In this slice brown dichroic mica is abundant. It becomes almost dark in some positions as the

polarizer is rotated. There are also a few crystals of hornblende, which is also strongly dichroic; but, as has been already explained in a former portion of this paper, there is little danger of confounding the two minerals. The orthoclase felspar is cloudy, appearing of a snowy white by reflected light. The hornblendes contain some bright green patches of decomposition matter.

2. (Slice 38). This slide contains a hornblende crystal 4·6 mm. along its vertical axis. The largest patch of quartz is 2 mm. by 1·8 mm. Triclinic felspars are present showing a beautiful banded structure under crossed Nicols. The quartz is clear and limpid, containing few inclusions other than the fluid cavities. The hornblende and biotite are the only minerals showing traces of boundary planes.

3. (Slice 34). The minerals present are quartz, biotite, felspar, orthoclase, and triclinic felspar. Fluid cavities are very plentiful in the quartz, numbers coming into the focus of the glass as the different planes are reached by the fine adjustment. The felspars are in places almost impellucid. A few crystals of magnetite are included in a flake of biotite.

4. (Slice 37). Under the microscope some finely striated, clear brown mica is seen. Even in the thinnest section it is strongly dichroic. When the cleavage lines are parallel to the plane of vibration of the light, the sections are black or very dark brown. A few crystals of apatite are enclosed in the quartz and biotite. A reddish-brown wedge-shaped sphene will be noticed on the margin of the slice. The biotite alters to a leek-green material that often preserves the dichroic character, but the cleavage lines are lost. The felspars as is usual are impure and cloudy, and the quartz beautifully pellucid. The hair-like microlites, to which reference has been already made, are abundant. Triclinic felspar is present, but not so plentiful as orthoclase.

Chemical composition of the Granite.

Specific gravity at 18·5° C..........2·85-2·93

I am indebted to Mr. Mingaye, F.C.S., of the Geological Survey Laboratory, for the following analysis of the granite. The

specimen submitted for analysis was fairly typical of the general character of the rock :—

Hornblende-biotite-granite.

Silica	66·69
Alumina	17·03
Ferric oxide	3·15
Ferrous ditto	·69
Manganous ditto	trace
Lime (Ca O)	1·82
Magnesia (Mg O)	2·50
Potash (K_2 O)	6·26
Soda (Na_2 O)	1·21
Phosphoric acid	trace
Sulphuric anhydride	trace
Titanic acid	trace
Moisture	·48
	99·83

Comparing the above with well-known granites, it will be seen that the Bathurst rock contains about 10 per cent. less silica than the normal type of West of England granite, while it is richer than the average granite in alumina and potash.

Basalt.

The basalts have been defined as dark-coloured lavas of basic composition and high specific gravity, representing the extrusive or volcanic type of the gabbros and dolerites. Dr. Geikie limits the term basalt to the contemporaneous lavas of basic composition.* They consist of a compact or finely granular ground mass, through which crystals of plagioclase, augite and olivine are scattered. Again, some authors use the terms dolerite, anamesite and basalt† for rocks which, chemically identical and all holo-crystalline, differ

* British Petrography, by J. J. Harris Teall, M.A.; London, 1888, p. 193.

† Professor J. G. Bonney—Anniversary Address to the Geological Society, London; Quarterly Journal Geological Society, Vol. XLI p. 70.

[redacted]

in the coarseness and fineness of their grains, so that the last term is applied to a rock which either may be holo-crystalline or may retain a glassy base. It would be convenient, then, to restrict the term dolerite to the holo-crystalline variety, using the epithet coarse-grained or fine-grained as the case may be; to apply the name anamesite to the hemi-crystalline varieties; and to include in the term basalt all that retain a glassy base.

The Bathurst rock I shall refer to under the name of basalt simply. It is not as fine-grained as the typical anamesite, nor as coarse-grained as a dolerite, and the amount of glass in the base is variable. I would describe the Bathurst basalt as a blue-black, compact, apparently homogeneous rock, that breaks with a splintery and conchoidal fracture, and in which the component minerals can be studied only with the microscope, unless occasionally scattered porphyritically through the mass. It occurs as a contemporaneous flow and consists essentially of triclinic felspar, augite, olivine and magnetite, with small portions of an unindividualised glassy base.* Zirkel, in studying the basalts of the fortieth parallel of North America, separated the felspar-bearing basaltic rocks into four distinct groups.† The Bathurst rocks would naturally fall into the group which he describes as "possessing a microscopically very fine-grained, totally crystalline aggregation of crippled microlites, largely felspar and augite, which serve as a ground-mass, in which micro-porphyritical and macro-porphyritical larger crystals of felspar and olivine, with occasional augites are distinctly and sharply embedded." Add magnetite and occasional patches of a glassy base, and the above description answers fairly well for the Bathurst rock. Of course, in speaking of basalts generally, we would call our rock a felspar

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* The fact of its being a contemporaneous flow does not affect the classification. I agree with the English geologists who refuse to accept the geological age of a rock as a character on which its nomenclature ought to be based. See Judd, "On the Tertiary Gabbros," &c., of Scotland, Q.J.G.S., Vol. XLII. p. 60.

† Zirkel, Microscopical Petrography of the Fortieth Parallel; United States Geological Exploration, p. 253.

basalt, which would distinguish it at once from the leucite basalts that are known to occur at Harden, Byrock, and Cobar. Compared with the basalts immediately around, those of Orange and Carcoar for instance, the Bathurst rock is distinctive enough. This is most easily detected in preparing thin slices for the microscope. Long before the slice is sufficiently thin, the Orange basalt is seen, by transmitted light, to consist of a felted mass of plagioclase, with augites and olivines for the most part wedged between. The Bathurst slice on the contrary will show micro-porphyritic minerals in a holo-crystalline base with an abundance of magnetite and drop-like grains of augite. Basalts of this type are not uncommon in Europe and America. The resemblance extends even to such minute details as the serpentinization of the olivines, and the sharp well marked features of the iron oxides. Zirkel's remark, relative to the American basalt, applies well to this Australian example. "It is worth while," he says, "to pause and remark that in these widely remote quarters of the globe the product of the solidification of a molten mass, although exposed to many casualties, has nevertheless maintained a surprisingly close identity of microscopical composition."*

Basalt in the Field.—A glance at the map accompanying this paper will show the extent of the basalt. It marks the course of an old river valley. At the outside it is not more than 150 to 200 feet in thickness where it lies deepest. It can be studied well at the quarries on the Bald Hills, where stone is obtained for road purposes. Perth railway station is very convenient to the hill marked F. Here the basalt forms one of those table-topped hills which, in the western district, are invariably recognised, even from a distance, as basaltic. The road from Perth to Evans' Plains crosses a saddle in the hills. On this road sections of decomposed granite are exposed, where the weathering of the rock can be noted. About half way up the hill water-worn pebbles will be found, increasing as we ascend. These have weathered out from the drift that lies between the granite and basalt. As soon as no

* Zirkel, l.c. p. 233.

more water-worn pebbles can be found, it may be taken for granted that the highest point of the drift and the lowest point of the basalt have been reached. The weathered surfaces of the rock on the hill tops show no evidence of the prismatic structure underneath. This prismatic structure may be seen in the quarries referred to. They are situated on the line A—B. The columns are utilised in their natural state for kerb stones. They break in some directions with a conchoidal fracture, while in other directions the stone can be broken in parallel flakes. From Perth the basalt may be followed without a break to the point marked L. Here there is an isolated hill with a basaltic cap, known as the Pinnacle. The table-topped hill overlooking Evans' Plains is the next remnant of the once continuous sheet. Then there is a long break to Mt. Pleasant, near Mr. Stewart's residence. Perth and Mt. Pleasant are the extreme points of the basaltic flow around Bathurst. Of course these points were not the original limits of the basalt plateaux. Allusion has been already made to the source of this basalt. Mr. Wilkinson pointed out that the stream came down from the neighbourhood of Swatchfield. Possibly a microscopic examination of the Swatchfield basalts could throw light on this question. It is certain, however, that no volcanic "neck" or traces of a crater exist within a radius of ten miles of Bathurst.

Very little has been done to expose the drifts under the basalt, so that some idea may be gathered as to the nature of the old valley. Along some points, where the basalt has been entirely worn away, there is an abundance of silicified wood strewn about the surface. This, no doubt, has been derived from the drift, and shows that the river valley flowed through a forest-clad region. At the present time the ridge of basalt forming the Bald Hills stands from 400 to 600 feet above the surrounding country. In the pre-volcanic days it was of course the lowest point. We have here, then, a splendid example of the effects of subaërial denudation. The old mountains and valley have both disappeared, and the untiring hand of Nature has spread out the material of which they were composed over the great tertiary plains of the interior. In this connection I must draw attention to a fact oftentimes

overlooked when dealing with our geology. We are, for the most part, accustomed to consider the material removed by denudation as eventually carried to the sea. None of the material removed by denudation from around Bathurst in Tertiary times ever reached any sea. It was disposed of in the same way as is the vast amount of material brought down each year by the Macquarie. None of this material ever gets to the sea, but is deposited over the plains between Dubbo and the Darling. "The precipitous and rugged country about the Upper Macquarie, the chains of basalt capped hills in the Bathurst district, and all the surfaces which form the valley of the river down to Wellington, have been carved into their present shapes by the subaerial influences of air, frost, rain, and rivers. Near Dubbo we might draw the line which would show the limit of deposition, denudation and deposition being synchronous and co-equal. The basaltic hills referred to have their representatives at Dubbo, but with their summits barely on a level with the surrounding country."* Professor A. Geikie describes geological features very similar to our own in a paper on the "Tertiary Volcanic Rocks of the British Islands." Referring to the ridge of Eigg, he says:—"In Eigg a fragment of the river valley has been preserved solely because it has been sealed up under streams of vitreous lava which could better withstand the progress of waste. Thus the Scùr of Eigg, like the fragments of the older basalt-plateaux of Auvergne, remains as a monument not only of volcanic eruptions, but of a former land surface, now effaced, and of the irresistible march of those slow and seemingly feeble agencies by which the denudation of a country is effected."

It is very probable that a columnar structure is developed along the line of hills, but unfortunately there are no natural exposures of this interesting phenomenon. A large opening has been made nearly on the line of section A B, Pl. xvi. Here the columns of basalt show well. Many are curved in a peculiar manner, but for the most part the columns are straight. Between the joints they vary in length from two to seven feet. The cup and socket

* J. Milne Curran, "Notes on Geology of Dubbo." P. L. Soc. N.S.W. Vol. X. p. 170.

[redacted]

structure so characteristic of the jointings in basalt is nowhere to be seen. The joints are planes, sometimes normal to the sides of the columns and sometimes forming small angles with them. As regards thickness, there is no uniformity in the columns. The average size might be taken as eighteen inches across. The weathering of these columns is rather noticeable. As the basalt decomposes it peels off in layers, and the centres of these films are fairly fresh. Plate XVII. shows this peculiar weathering.

The columns are, for the most part, tetragons, pentagons, and hexagons. With regard to the relative frequency of the various kinds, the following may be taken as a fair estimate—tetragons 4 per cent., pentagons 20 per cent., hexagons 65 per cent.

I made some measurements of the angles of the basaltic columns with these results:—

Tetragons (sum = 360°):

(i.)	a	93°	(ii.)	a	113°
	b	110		b	81
	c	88		c	83
	d	68		d	82
		359°			359°

Pentagons (sum = 540°):

(i.)	a	112°	(ii.)	a	133°
	b	121		b	118
	c	81		c	100
	d	115		d	98°
	e	95		e	89
		524°			538°

(iii.)	a	114°
	b	130
	c	80
	d	105
	e	96
		525°

Hexagons (sum = 720°):

(i.) a	117°	(ii.) a	113°
b	132	b	133
c	118	c	111
d	120	d	111
e	123	e	123
f	107	f	124
	717°		715°

In hand specimens, the Bathurst basalt bears a strong resemblance to the Rowley Regis basalt of Staffordshire. It is not unlike, in its texture, a basalt in my own collection from Madeira. It differs, however, from the basalt flows of the same age about Orange and Dubbo. It is commonly known as "blue metal," and I think that the Bathurst rocks have a decidedly bluer shade than the generality of western basalts. This peculiar blue-black is noticeable only on fractured surfaces, polished surfaces being very dark or almost black.

Microscopic Structure of the Basalt.—I have cut thirty slices of this basalt, collected at various points between Perth and Mt. Pleasant. Five slices were cut from rocks from the high hill overlooking Perth. Ten slices were made from the columnar basalt in the quarries already referred to, and were taken from an average depth of fifteen feet from the surface. A few slices were collected from the hill known as the Pinnacle, and the remaining number from Mt. Pleasant. Under the microscope there is no essential difference between any of the slides. In fact there is not even a structural difference between the slices from the most widely separated localities.

In grinding down the sections, the first mineral to show is olivine. While the section is still comparatively thick, the microporphyritic crystals of olivine are seen as clear spots in the, as yet, opaque slice. The next mineral recognisable is invariably the augite, and as the section thins down the plexus or network of the tiny felspars becomes visible. As the section grows thinner, the

base resolves itself into tiny globules of olivine, augite and felspar. In this ground-mass augite is much more abundant than would be supposed at first sight. In every slice black grains of magnetite are plentiful, and remain opaque in the thinnest sections. It is usually well preserved and shows no signs of decomposition. It was the first mineral to separate from the glassy magma, and is the only primary constituent ever enclosed in the olivines. Broadly speaking, the structure is decidedly micro-porphyritic.

A "streaming of the felspars" is a very characteristic structure at once recognised under the microscope. It is hardly pronounced enough, however, to be termed a fluxion structure. The lath-shaped plagioclases are often seen sweeping round the larger olivines and augites, pointing, without doubt, to movements in the molten magma. This structure is shown on Pl. XIV. figs. 4 and 5.

The abundance of black magnetite which remains opaque even in the thinnest slices is the next feature to attract attention. From Professor Judd's researches, I could conclude from this feature alone that the rock cooled at or near the surface. As Professor Judd remarks,* in most deeply-seated rocks the iron oxides enter into complete combination with the silicates, and in other cases there is a progressive increase in the quantity of magnetite which is separated according to the proximity to the surface at which consolidation has taken place.

Magnetite was one of the first minerals to separate from the magma. It is the only mineral ever included in the olivine, but its enclosure in this mineral is a very common occurrence. The large olivine crystal on Pl. XIV. fig. 4, shows a cube of magnetite. The felspars, too, it will be noticed, seem for the most part perfectly fresh and unaltered. These plagioclases exhibit parallel twin-striation in polarized light, a feature common to rocks of this sort throughout the globe.

The olivines are abundant in every slice, showing, as is usual, that peculiar ground glass surface which helps to identify it.

* Q.J.G.S., Vol. XLII., p. 88.

Olivine is of course no longer regarded an essential constituent of basalt, but it occurs in such remarkably fine crystals in these rocks that their presence distinguish it at once from all Australian basalts with which I am acquainted By taking a micro-photograph and cutting out the portions representing the olivines, the percentage of olivine can be calculated. With the porphyritic crystals this is easily done, but in estimating the granular olivines of the base a large margin for error must be allowed. The application of this method is common with petrologists, and was originally devised by Dr. Sorby.* I have cut several micro-photographs in this way with fairly even results for the average structure of the rock.

Porphyritic olivine ...	...	...	13 per cent.
,, augite	...	...	9 per cent.

This comparatively large percentage of olivine would bring the rock under Rosenbusch's class of olivine-basalt.†

Besides the large crystals of olivine there is the granular olivine which with augite and felspar form the base. Under a magnifying power of 100 diameters a micro-photograph can be got of this granular base, from which the parts representing olivine can be cut. My experiences gave me 23 to 29 as the percentage of this mineral in the base.

A glance at the micro-photographs appended will show the presence of porphyritic augites. But there is also a very large amount of augites in the micro-granular ground mass. The quantity of augite is easily shown by treating the slice (after first getting a micro-photograph) with warm hydrochloric acid. After four hours' digestion, the magnetite, serpentinous matters and olivine dissolve, and the felspars and augite only remain; olivine and magnetite being soluble in HCl., while the augite and plagioclase are scarcely affected.

* J. J. H. Teall, "Petrological Notes on some North of England Dykes." Q.J.G S., Vol. XL., p. 216.

† H. Rosenbusch, Micro-Physiographie der Massigen Gesteine, Zweite Auflage, p. 733.

Another reaction that renders the olivine of the ground-mass distinct enough from the augite is effected by treating the slice with warm HCl., until on gently drying the olivines gelatinize slightly, when they can be stained by fuchsin. The olivines will then stand out in marked contrast to the augites.

In many of the slides patches of an isotropic glass can easily be detected, particularly with the help of the quartz plate. The glass often seems of a light wine-red colour by transmitted light. I notice that prolonged treatment with acid has no appreciable effect on this substance. The glass is, therefore, not of a tachylytic nature, but more acid in character.

From what has already been said it will be gathered that there are two generations of olivine, augite and felspars in the Bathurst basalts. This is quite in keeping with the observations that have been made on similar rocks in the Old World. In the peridotites it is common to find olivine in the ground-mass and the same mineral as porphyritic crystals. In many dolerites labradorite and augite form the principal ingredients of a ground-mass in which the same minerals occur porphyritically.* I have met with no explanation altogether satisfactory of this common condition of igneous rocks. In the paper just referred to Dr. Bonney remarks that although an explanation of these anomalies does not seem hopeful, we may bear in mind that the temperature of consolidation for a mineral out of a magma is not necessarily identical with that of the isolated mineral, as one substance acts as a flux on another.

As throwing some light upon this interesting question of the separation of minerals from a molten magma, the following extract from a paper by Professor Judd applies to our own rocks.

"In some instances the mechanically injured condition of the crystals and other appearances strongly suggest their actual transport from below in the midst of the materials of the surrounding ground-mass. But in others the porphyritic crystals exhibit zoned structures and other characters not found, perhaps, in the deeper-

* See Professor T. G. Bonney, Q.J.G.S., Vol. XLI., p. 79.

seated rocks of the class in the same area. May we not in these cases explain the phenomena in the way suggested by M. Michel-Lévy by the consolidation having taken place at two different periods? It is not difficult to imagine conditions which would bring about such a result. If, for example, a mass of igneous materials were in a liquid state at a great depth from the surface, the conditions might be favourable to the separation of a felspar of a given composition from the magma. The continued abstraction of certain elements from the base would alter the composition of the surrounding magma, and this would modify slightly the conditions causing the successively formed zones of the crystal to vary slightly in composition. But if a fissure were formed above such a molten mass, then the pressure upon it would be greatly and suddenly relieved, even though no actual movement occurred in the deeper seated portion. Under the entirely new conditions thus originated, the magma surrounding the zoned crystals already formed might be induced to crystallise in a totally different manner, the order of the separation of the minerals and the forms and relations of their several crystals being determined by these new conditions."

As some of the minerals in the basalt present features worth noticing, I may refer to the characters they present when seen under the microscope.

Olivine.—The porphyritic crystals of olivine are so abundant that, with very few slides, sections may be found in various zones sufficient to study its leading optical properties. I have noticed sections close to basal planes, and sections approximately parallel to the macropinacoid, so as to show an interference figure in convergent polarized light. Sections roughly showing the form of an elongated hexagon are plentiful. The peculiar ground glass surfaces, due to its high refractive index, are very pronounced. In fairly thin slices the mineral shows a very faint yellow-brown colour. But the most remarkable feature in the olivine is the fact that it is the first mineral in the rock to fall a victim to alteration. Every large crystal shows serpentinous lines of

decomposition. I have not met with an instance where the alteration is complete. The green serpentinous matter follows the cracks and cleavage lines and gradually eats its way across the intervening spaces. The micro-photographs on Pl. XIV. figs. 2 and 4 show this change clearly enough.

The edges of the olivines are sharply defined and show little or no signs of corrosion. The form of the crystals does not seem affected in any way by the surrounding minerals, so that, to use a term of Rosenbusch's, they are for the most part idiomorphic. Inclusions of magnetite are common, as well as patches of a semi-devitrified glassy base. It is more than probable that some of the large olivines were formed at a depth and floated up before the second generation of olivines consolidated. On Pl. XIV. fig. 1 will be noticed a crystal of olivine that was broken along a central line; one half is seen in the micro-photograph, and the other half is found on another part of the slide.

Augite.—The augite in the Bathurst basalt is not penetrated by the felspars, so as to give rise to an ophitic structure. But the consolidation of the augites must have been subsequent to that of the felspars. The augite is sometimes to be seen partly moulded around the ends of the laths of plagioclase. An example is shown on Pl. XIV. fig. 5. Here a large zoned augite is seen partially penetrated by a felspar as if the latter was forcibly carried against the augite when the pyroxene was still in a plastic condition.

On slide 41 an augite will be found with well defined edges. It shows a figure in convergent polarized light. Faint traces of cleavage lines seemingly parallel to the prism can be detected, so that it is evidently a basal section. The same slide shows some good examples of zoned and twinned augites. On slide 46 a fine example can be found of a porphyritic augite sliced in the clinopinacoidal plane. The crystal is partially penetrated by a felspar, and with inclined Nicols shows the well known hour-glass structure often noticed in augites.

Felspar.—Mr. A. W. Howitt made some measurements of the felspars in this basalt, and noted that, as all the obscuration angles

measure 20° in the zone OP $\infty \bar{P} \infty$, the felspars were not more basic than andesine. For the present it will be sufficient to describe the felspar, whether andesine or labradorite, as plagioclase. Twin crystals are very common in every slice. Sometimes broad cruciform twins are seen, one good example of which may be noted on slide 41.

Magnetite.—I have never isolated the black crystalline bodies which I have provisionally named magnetite. On being analysed they may prove to be ilmenite or titaniferous magnetite. By drawing a magnet through detrital matter, near the basalt, large quantities of a magnetic iron can be collected. This gives a strong reaction for titanium. I have not been able to decide whether this may not be derived from the adjoining granite.

The magnetite in the basalt I take to be a primary constituent. It is invariably sound and undecomposed. It can be noticed enclosed in clear augites and olivines. I have noticed secondary magnetite in other basalts, but in that case the olivine and some of the augite had disappeared, and the iron of the ferro-magnesian minerals was represented by the magnetite. The augites in our rock are beautifully clear, and no olivines are wholly decomposed.

I have selected three slices as fairly representing the microscopic character of the whole basalt. I will describe their general structure.

1. (Slide 45). The micro-porphyritic structure of this slide is just visible to the unaided eye. Under the microscope large olivine crystals are seen, set in a paste or granular base of magnetite, augite and felspar microlites. The olivine crystals are beautifully clear, magnetite and blebs of glass being the only inclusions. The olivines are better preserved than in most slices, showing very little signs of serpentinization. The streaming of the felspars is very characteristic. One large olivine has evidently moved when the paste was partially set, as it is seen to have pushed on either side a collection of felspars. Besides the lath shaped felspars, broad rectangular plagioclases of another species probably are represented. The magnetite crystals seem disposed to gather around the edges of the augites and olivines.

2. (Slide 48). Large twins of augite can be detected without the use of the microscope, their yellowish-brown colour contrasting with the other almost colourless minerals of the slice. Under the microscope the greater number of the lath-shaped felspars show incomplete terminations. A few small olivines are seen altered completely to a light green serpentine. Many other patches of a like green secondary product, that show no definite boundaries, originated in the same way. All the magnetite seems a primary constituent. A few large augites show lines of uncertain inclusions just inside their boundaries and parallel to the outer edges of the crystal. With inclined Nicols, faint traces of zones can be detected. There is very little glassy matter.

3. (Slide 9). Under the microscope, shows the general structure of the Bathurst basalt. Porphyritic crystals of augite, olivine and plagioclase, set in a much finer ground mass of the same minerals, with cubes of magnetite abundantly developed. The felspars flow round the augites, but are not seen to penetrate them, so there is no arrangement approaching to the ophitic structure. Patches of a light red isotropic body are seen set in the dark hemi-crystalline base. It is probably glass. The large compound augite has some inclusions of the same material. The augite contains well marked cubes of magnetite as inclusions. The olivines are seen cracked in directions evidently independent of the cleavage lines. They are also somewhat corroded along their outer edges.

The microscopic structure of the basalt is so uniform along its length in the field that the above descriptions may be taken as fairly typical of the whole.

Chemical composition of the Basalt.

Specific gravity at 18·5° C.........2·63-2·75

Silica ....,.........	44·67
Alumina	21·38
Ferric oxide..................................	2·82
Ferrous ditto................................	5·99
Lime (Ca O)........	10·24

Magnesia (Mg O)	9·58
Potash (K_2 O)	1·03
Soda (Na_2 O)	2·70
Phosphoric anhydride	·22
Sulphuric ditto	trace
Titanic acid	trace
Moisture	·79
	99·42

For this analysis I am indebted to Mr. J. Mingaye, F.C.S., Analyst to the Department of Mines. The chemical composition shows a basic rock quite in keeping with its microscopical characters.

To facilitate the future study of the rocks of Bathurst, I now append a few remarks to point out the means of seeing the various features of interest in connection with the district. The passage from a granitic to a slate country, and the characters that accompany the change, can be observed in a morning's drive. By taking the Peel Road, *via* Kelso, tertiary drifts are seen on the right from Kelso to the trigonometrical station, at the first turn to the right. Granite country continues until the descent is begun to the valley of the Winburndale Creek. In this creek, and in a small tributary already referred to, contact rocks can be noted. When the village of Peel is reached the student finds himself in the midst of slate country. Take the road that leads back to Bathurst, *via* Duramana. Some worked out alluvial deposits can be examined on the creek. With a local guide then follow the road to Rankin's Bridge, *via* Kelly's farm and Duramana. About Kelly's farm hornfels rocks, semi-granites, and the weathering of granitic boulders can be studied. Getting on to the main road to Rankin's Bridge we are again in granite country; outcrops of the rock are plentiful near the bridge. From the road near Seage's farms good views can be had of the sheets of the basalt away to the south, forming the Bald Hills at one extremity and Mount Pleasant at the other.

On reaching Peel another route could have been taken. Beyond the village a road leads away to the right through Silurian slate country. This road joins the Bathurst Limekilns road, which latter can be followed home. At the bridge crossing the Winburndale, good casts of Brachiopods—*Spirifer* and *Rhynchonella*—can be found in the water-worn pebbles of the creek. These have been washed down from the Devonian sandstones that are extensively developed up the valley.

A very good idea of the slate and schist country about Cow Flat can be gained by driving south through Perth, and following the Rockley Road to the top of the first range. Here contorted slate, clay slate and crystalline limestone crop out. A road through Cow Flat to George's Plains railway station leads away to the right. Along this latter road splendid examples of metamorphosed rocks, slate country and quartz reefs can be seen.

Basalt is best seen by ascending the Bald Hills at Perth, and then following a track that leads along the hill tops to Bathurst, *via* the basalt quarries and Poor Man's Hollow. A separate trip should be taken to study the drifts and basalt on the hill over Evans' Plains, and the same rocks at Mount Pleasant.

The localities of the contact rocks have been already referred to in sufficient detail.

X. Economic Geology.

Gold.—There is little prospect of finding payable gold in quantity immediately round Bathurst. It is not probable that it has been derived from the granite. We therefore fall back on the only alternative that it has been drifted from a distance. And the nearest auriferous country whence it could have been derived is too far away to leave any hope of heavy deposits.

Granite.—For building purposes the granite will hardly ever become a marketable commodity. Even at a depth the felspars are kaolinized and the whole rock suffers from incipient decomposition. True it will take a polish, but I have had an opportunity recently of examining a polished slab of Bathurst granite that had been exposed to the weather for eleven years. Already the laminæ

of biotite were fraying out, and the large hornblendes were honeycombed and had quite lost every trace of polish. Disintegrated granite is used extensively about Bathurst for walks and gardens in the same way as gravel is used in other countries.

Basalt.—The basalt is used extensively for road making, for which it is admirably suited. It is fortunate that there is so large a reserve of this useful rock in the vicinity of the town. It is sometimes used for building purposes. The basalt can be easily dressed with a hammer into rectangular blocks, and buildings in which it is used must be of an enduring nature. Its very dark colour is its only fault. It is as durable as any building stone need be. Some that has been in use for fifteen years shows no trace of weathering, being so dense and compact that not even a lichen had taken hold on its surface.

Kaolin. The deposits of kaolin have been frequently tested and condemned, chiefly on account of a rather high percentage of iron that they contain. When good fire-clay and kaolins are so easily procurable in the colony, it is hardly likely that the Bathurst article will prove of economic value.

Copper.—The lodes of copper about Cow Flat were at one time extensively worked Many who are familiar with the underground workings are of opinion that they will yet prove a source of wealth. The whole country about Cow Flat is highly favourable for mineral deposits. A belt of highly mineralized country runs from here along the granite boundaries. Large deposits of pyrites occur in highly metamorphosed slates. Very little has been done to test their value.

To the north of Bathurst the country about Peel seems favourable for auriferous reefs. Odd samples of copper-stained rocks are occasionally found in the metamorphic rocks round Duramina. These point to the occurrence of copper lodes not yet discovered.

Clays.—Excellent clays for brick-making are found all along the alluvial flats. Where the alluvial material mingles with the decomposed basalts the bricks improve both in quality and colour.

XI. Other Points of Interest.

About eighteen miles to the north of Bathurst some very interesting geological country is easily accessible, particularly about the Limekilns and the Ben Glen caves, where good collections of Silurian fossils can be made.

At Blayney a finely typical example of the interesting rock diabase occurs. It will be found in a small quarry near the R.C. Church. To the naked eye it might pass for a diorite, but on slicing the rock it is seen to consist entirely of felspar, magnetite, and a monoclinic pyroxene, augite. The augites are porphyritic, and many of them beautifully zoned.

At King's Plains, near Blayney, rich and extensive patches of gold bearing drift are known to occur, which have not been worked chiefly on account of the great body of water that has to be contended with. Gold also occurs here in a steatitic slate, which once contained large quantities of pyrites. The pyrites has altogether disappeared, but the rock is full of cubical cavities pointing to its former existence.

I have in my own collection a monster twin pseudomorph of pyrites found here, in which the faces of the cube measure two and a half inches.

About Carcoar some highly interesting gabbros are extensively developed. These are holo-crystalline rocks of coarse texture, consisting of pyroxene and felspar. In calling these rocks gabbro I follow Professor Judd's classification in his paper on the gabbros of Scotland and Ireland.*

At the Three Brothers Hills, between Bathurst and Blayney, an interesting basalt is found with a flaggy structure. I have not examined the locality, but I have seen slabs of basalt brought in from there varying in thickness from two inches to four.

Steatite is found in a slaty condition about Rockley and Locksley.

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* Q.J.G.S., Vol. XLII., p. 61.

Wood opal, that polishes well, can be collected in some paddocks between the cemetery and Mount Pleasant. Good fire opals are known from Rocky Bridge Creek, where they occur in a decomposed trachytic lava flow. Good coloured amethysts and rose quartz are frequently brought in from the country between O'Connell and Oberon.

XII. Conclusion.

1. Getting results together we find that about Bathurst granitic rocks are extensively represented.

2. This granite area is surrounded by an aureole of metamorphic rocks.

3. There is no insensible gradation from a clastic to a holocrystalline rock, from a sedimentary rock to a granite.

4. The granite is intrusive as regards the surrounding slate rocks.

5. This is not necessarily opposed to the view that part of the granite may have been formed by a whole or partial fusion of pre-existing sediments. Like the granites of Vancouver, the Bathurst granite is probably at once intrusive and, in a sense, metamorphic.

6. The silurian slates are the oldest rocks now represented in the district—older than the underlying granites.

7. The granite comes next in order of time.

8. The granite rocks underlying the slates are not the floor on which the slate rocks were originally laid down.

9. This floor has entirely disappeared through sinking within a zone of fusion, or through being absorbed by an ascending molten magma.

10. Under the microscope the granite is a hornblende-biotite-granite with a triclinic felspar.

[redacted]

11. On a microscopic examination the "blue metal" is found to be a true olivine basalt and an old lava flow that filled up an ancient river bed. The point of eruption was near Swatchfield.

No doubt pages and chapters of the geological record are missing, but the foregoing is my reading of the history of Bathurst as written in her rocks.

EXPLANATION OF PLATES.

Plate xiv.—Reproduced from microphotographs of thin slices of Bathurst basalts. Fig. 1, ×50, shows the general structure of the basalt at Pinnacle Hill. To the right two olivines are seen, traversed by serpentinous lines of decomposition. The lower olivine represents one half of a crystal, the other half of which floated away to a considerable distance. The lath-shaped felspars show a tendency to stream round the large crystals. Fig 2 is a basalt from Mt. Pleasant, enlarged 50 diameters. A very characteristic olivine occupies the right of the figure. The dark lines following the cracks are bright green decomposition products. On the other side of the figure there is a large plagioclase, containing some inclusions of the base. Fig 3 shows a thin slice of basalt from the quarries at Bald Hills, enlarged 50 diameters. At the top of this figure there is a portion of a microporphyritic olivine, and some distance below a basal section of augite. These and other large crystals are set in a micro-crystalline ground mass. The lath-shaped felspars show a decided flow. The magnetite is very abundant as black grains. Fig. 4, ×90 diameters Under this magnifying power magnetite shows clearly. The large olivine in the upper portion of the figure shows inclusions of this mineral, one being a perfect cube. The other large crystal is an idiomorphic augite. Between these two crystals a streaming of the felspars is very noticeable. It will be remarked that the felspars have incomplete terminations and sometimes bifurcate at either extremity. Fig. 5.—In the lower left hand portion of this figure a large augite is seen partially penetrated by two plagioclase prisms. The smaller lath-shaped felspars flow round the augite in an interesting manner. Magnetite is scattered through the slide. The two clear spaces at the top are olivines. The thin slices in Figs. 4 and 5 were cut from basalt used for kerb-stones in Bathurst, and quarried on the Bald Hills a few miles south of the city.

Plate xv.—Fig. 1 shows a vein of granite intruding a much altered sedimentary rock. Between Brewongle and Locksley this section is exposed

in a railway cutting. Fig. 2 shows an intrusive vein in Silurian slates, on the outer boundary of the granite, near Newbridge. Fig. 3 is a sketch of forking veins of binary granite, near Newbridge. Fig. 4 shows a younger and lighter coloured granite penetrating a dark coloured rock of the same character. Figs. 5 and 6 show veins of granite cutting through altered sedimentary rocks. These were sketched in the Winburndale Creek, above the bridge on the Bathurst-Peel Road. Fig. 7 represents junctions between slates and granite. The line of junction is very sharp and well defined, and is exposed in a railway cutting on the Bathurst side of Newbridge railway station.

Plate xvi.—The highest point of the basalt is about 600 feet above the river. The drift which is shown under the basalt was pierced by a tunnel. The relations of the rocks to the sections are drawn from notes made during the progress of the tunnelling works. Fig. 2 gives the relative positions of all the basalt around Bathurst. Some four miles of the ridges do not show in the sketch, as at the left of the section the chain of hills bends away south at right angles and so is hidden from view. The view is from the north.

Plate xvii.—Prismatic basalt, Bald Hills. This quarry is very nearly on the line of section marked A B on the map. The weathering of the rock is shown. Large flakes of decomposed matter peel off the sides of the prisms. These flakes are from half an inch to one and a half inches in thickness, and often contain a core of undecomposed basalt. As work goes on it is probable that better columns will be exposed.

Plate xviii.—Sketch map representing the boundaries of the basalt as accurately as is possible on this scale. It is easy to join the isolated patches and thus trace the former course of the river.

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REMARKS ON POST-TERTIARY *PHASCOLOMYIDÆ*

BY C. W. DE VIS, M.A., CORR. MEM.

In furtherance of some future catalogue of the post-tertiary fossils of Queensland locally preserved, the wombat contents of the collection have in their turn undergone examination. From that scrutiny one rises with the impression that our recorded knowledge of the family is not in every respect as certain or, on the whole, quite as complete as it might be, and there ensues a desire to ask that one judgment delivered respecting them may be reconsidered, and one species added to their number. But before all things it is obligatory to declare that the task of determining the extinct species of *Phascolomys* could not have been undertaken at the antipodes prior to the publication of Mr. Lyddeker's Catalogue of Fossil Marsupials, followed by the Catalogue of Recent Marsupials placed in our hands by Mr. Thomas. To the labours of both these writers we in Australia are deeply indebted. But we may presume that neither of the authors would insist upon his determinations being considered as in all cases final, for it must be that conclusions based on a comparatively small number of specimens, or upon descriptions alone, will undergo some modification. More especially is this to be expected in cases of opinion founded on a few cranial remains of the wombats that were. Naturalists will agree that if we neglect the "personal equation," observation may generally be taken to vary in value as the material observed varies in quantity, and on this account they will not mistake for an idle vaunt the statement that the collection of wombat fossils examined contains over two hundred specimens, exclusive of vertebræ, and so forms, it is believed, by far the largest series as yet gathered from that prolific field, the valley of the Condamine.

To begin with a general conclusion, the opinion which I have previously ventured to express, namely, that the ossiferous deposits of the Darling Downs and those of the Wellington Caves are not upon the same palæontological horizon, receives support from the phascolomine peculiarities of their respective contents. So far as can be learned from the British and Queensland collections, the cave wombats, *P. latifrons*, *krefftii*, and *curvirostris*, were not in existence when the Queensland breccias and turbaries were laid down; and, on the other hand, *P. parvus* and the species to be described in the sequel had disappeared before the Wellington caves received their contents. It would not be reasonable to accept in explanation of the apparent facts the supposition that they inhered in contemporaneous but diversely conditioned faunas. The habitats were too near to each other and persisted under geographical conditions too similar in kind, and on the whole too continuous one with another to leave any plausibility in the suggestion. But if the faunas were successive, as the alternative supposition must affirm, they denote the limits of a great interval of time, of a space sufficient to effect in this particular instance the extinction of two and the development of three species. The lapse of some considerable part of this interval has probably been notified to us by certain fossils which show that one of the associations characteristic of the Nototherian age, *Ceratodus* with a fresh water saurian, was still permanent in Southern Queensland when the denudation of the basalt had so far progressed as to cause the formation, in suitable positions, of deep beds of "black soil" Teeth of the fish and alligator with other vertebrate remains, (including a piece of a chelonian carapace of great thickness identical with fragments from the Downs), all evidencing a first burial *in situ*, have been met with near Brisbane at a depth of 80 feet in a dark basaltic loam with celestine and other derivative minerals. These interesting fossils are deposited in the Queensland Museum.

A second conclusion is that that no living species of wombat has come down to us from the age of the Condamine beds. This is an assertion which contradicts accepted evidence, and will, therefore,

have to be substantiated by further and, as it appears to me, more conclusive evidence. Assuming its truth for the moment we must accept the consequence, that the cave fauna, in which we are told there appears an existing species (*P. latifrons*), is partially of later origin.

Phascolonus, Owen, is demonstrably a good genus, but the ground on which it has been separated, namely, by identification with *Sceparnodon*, a determination so improbable in itself that nothing short of direct proof should suffice to give it currency, appears to me quite inadequate, to say the least. Owen's suspicion that this great wombat in skull and teeth might one day show itself to be generically distinct from *Phascolomys* was a happy conception, but it is not by means of the teeth and skull exclusively that its differentiation may be proved. In each of the other known parts of its skeleton there are departures from normal phascolomine characters amply sufficient to determine the judgment in favour of its separation from *Phascolomys*. It is unnecessary to go into details to settle an undisputed question, but to anticipate an objection which might be taken to proofs derived from isolated bones in this and other cases on account of the uncertainty attaching to their determination, it may be permissible to state the process by which the identification of Phascolonus bones was ascertained.

While taking measurements of the bones of a *Phascolomys platyrhinus* for comparative purposes, it was observed that the width of the distal end of the humerus corresponded very closely with the length of the upper molar series, the millimetres being 54·5 and 53·5 respectively. Naturally it seemed not impossible that a similar equation might obtain in an extinct species. To put the notion to the test search was made for a phascolomine humerus which should be in width about equal to the length of the series of upper cheek teeth in a *P. gigas*, namely, 105 mm. The bone was fortunately discovered and found to measure 104 mm. It was then assumed with some degree of confidence that twice the linear dimensions of *P. platyrhinus* might be

adopted as a metrical guide to the recognition of any other *Phascolonus* bones in the collection, or conversely that any phascolomine bones found to yield the required measurement in two dimensions might, with the consent of other characters, be taken as belonging to the same animal as the skull, and on this basis the identifications of the proximal end of a second humerus, two femurs, three tibias, a fibula, two scapulas, two ulnas, a radius, ischium, trapezium, trapezoides, astragalus, naviculare, calcaneum and cuboid, or characteristic parts of them, were successively established. It may be well to state distinctly that while these bones are unmistakably phascolomine they almost invariably present conspicuous marks of differentiation from *Phascolomys*—for examples, the bridge across the entepicondylar canal of the humerus does not subside at once into the shaft as in the pure wombats, recent and extinct, but is continued upwards as an elevated ridge, merging into the deltoid ridge above, and the astragalus has its rotular groove deeply sunken and all its ridges elevated, whereby it is easily discriminated from the smooth-surfaced bone of *P. medius* and its dwarfed copy in the recent *P. platyrhinus*. At the same time it must be observed that the extent of differentiation shown by these bones is by no means so great as that which we shall probably find to be correlated with the non-phascolomine incisors of *Sceparnodon*.

In addition to the above-named bones of the tarsus, there are in the collection several which show that although the animal was as a rule about twice the length of *P. platyrhinus*, it not unfrequently exceeded that length by more than one-third. The astragalus referred to is 44 mm. in breadth, against 22 mm. in the living *P. platyrhinus*, but by its side is a second measuring 51·5, another 55·5, and still another 60 mm., yet no one of these can be specifically distinguished from the rest. The naviculare again is accompanied by two others, the respective lengths of the three being 41·5, 54, and 56. With the largest astragalus are associated its naviculare, calcaneum, and cuboid, and arranged with them are the four metatarsals, but these have been contributed by other feet. Of foot bones of this larger size there are in all sixteen

examples, or nearly a third of the whole number of cranial and appendicular bones of *Phascolonus* in the collection.

Adverting to the smaller species—on the assumption that the living *P. platyrhinus* is identical with the fossil *P. mitchelli*, as it is said to be, the latter is the only recognizable species of its size as yet recorded from the Darling Downs. *P. thomsoni*, Ow., is an extremely doubtful species, uniquely represented, and dependent for its validity upon a single character, the backward extension of the symphysis, a character which varies with age and, in mandibles of *P. mitchelli*, shows its inconstancy thus:—in one example it extends to the fore lobe of m^3, in four to the interval between m^3 and m^2, in five to the hind lobe of m^2, and in four to the interval between m^2 and m^1. *P. thomsoni* should, therefore, be expunged from our lists. But whether it be so or not is of slight moment in a question of appeal to bones other than those of the head. A species which has left us but a single fragment of its jaw is not likely to have handed down other parts of its skeleton; at any rate it is not entitled to priority of consideration over those whose cranial remains are numerous. We may, then, for the present proceed on the assumption aforesaid, namely, that there was but one wombat of the size of *P. platyrhinus* to remit its limb bones for study; then as bones of a wombat of that size, showing the like dimensional correspondence with the teeth of *P. mitchelli* as that observed in the case of *P. gigas*, are extant, the question simply is, are they, as the identification requires, fossilised bones of *P. platyrhinus*. One answer alone is possible, they are not. If not, then either the numerous cranial and mandibular remains of platyrhine wombats referred to *P. mitchelli* in the Queensland Museum, and there constituting it the commonest species, belong to some undescribed species unknown in the British Museum, and not to the species also most numerously represented by such remains in the British Museum, or the identification is at fault. It is now incumbent upon me to show that these bones, which under the circumstances must necessarily be ascribed to *mitchelli*, are not bones of *platyrhinus*. They comprise two humeri, three femurs, a tibia, and two ulnas.

The humerus is seen at a glance to be much stouter, but as the condylar region of the more perfect specimen is wanting its relative proportions cannot be ascertained with precision. With an approximate length of 124 mm., against 122 in *platyrhinus*, the width of the shaft at its proximal third is 3 mm., its antero-posterior thickness 2·5 mm. greater; it is, therefore, 2·5 mm wider than in a recent bone of the same length; at the proximal end the long diameter of the head and greater tuberosity is 2·5 mm., the short diameter across the head only 0·8 mm. greater; in this region it is, therefore, relatively longer and of a different form. Although the head is but little larger antero-posteriorly, it is produced downwards upon the hinder surface of the shaft much more than in *platyrhinus*, more even than in *latifrons*, and with a still more angular margin than in the latter species. The importance of this exaggeration of one of the features peculiar to *latifrons* should be duly appreciated. The ectotuberosity, as to size, is in about the same proportion to that of the head as in *platyrhinus*, but it is smoother, more symmetrical in form, wants the triangular facet, and descends lower on the shaft, the extent of its base on the thenal side is platyrhine rather than latifront. In the extension of the transverse diameter of the proximal end of the shaft we see, on the other hand, a second latifront character in excess. The lesser tuberosity resembles that of *platyrhinus* but is not so distinctly grooved off from the head, nor does it descend in a pointed form on the entothenal edge. The teretotriceps ridge is extremely short and in shape oval, very different both in form and extent to that of either of the living species; midway between it and the head is a tuberiform ridglet, perhaps an outlier of the other. The pectoral ridge is an elevated line descending continuously from the greater tuberosity, in other structural respects most nearly resembling that of *platyrhinus*, but differing in position as it marks off the inner third instead of the inner half of the shaft. The prominence and retroflexion of the angle of the deltoid ridge are intermediate in degree between those exhibited by *platyrhinus* and *latifrons*. The deltoid and pectoral ridges do not converge distad, the surface between them is comparatively flat, and the

only representative of a predeltoid ridge is a low prominence just proximad of the middle of the long oblique margin joining the ends of the two ridges. The breadth of the delto-pectoral surface is 15 mm. against 12·5 in *platyrhinus*, wherein again we recognise an intermediate character. The triceps ridge on the anconal aspect of the shaft is still less developed than in *platyrhinus*. The absence of the supinator ridge and of the condyles precludes further comparison, but perhaps enough has been said to render it unnecessary. It may already appear that the bone, so far from representing *P. platyrhinus*, has several characters which suggest that, on the whole, *P. mitchelli* was less specialised than are the living species of which it was probably the common source.

Of the femur the length and the least transverse diameter are respectively 168 and 17·5 mm., in *P. platyrhinus* they are 163 and 14·5, in *P. latifrons* 141 and 17 ; *platyrhinus* it would seem has retained length and lost thickness, *latifrons* has lost length and retained thickness. The breadth of the distal end (39 mm.), the transverse diameter of the head (36·5), and its antero-posterior diameter (26) are all greater than in either of the continental species living. As in the humerus, so in the femur, the head descends considerably lower and overhangs the shaft to a greater extent than in existing forms. The lesser trochanter is relatively larger in all its dimensions ; the rough-surfaced excavation in front of its distal extension is much broader and deeper but has no sunken pit at its proximal end ; the subtrochanterian ridge is more exactly reproduced in *platyrhinus* than in *latifrons*. Between the summits of the two trochanters the distance is 47·5 mm. against 44 in living species, consequently the neck is proportionately broader. The inner condyle is 36 mm. in its antero-posterior dimension, that of *platyrhinus* being but 31, and its superiority in height over the outer condyle is, therefore, more conspicuous ; the outer condyle is more distinctly grooved off from a rather broader ectepicondyle ; the intercondylar notch is wider, the anterior limit of its surface better defined, its whole surface comparatively smooth ; a convexity of the surface near its posterior end forms a low transverse bar between the condyles. Of the deep pit seen in

the shaft at the base of the outer condyle of *platyrhinus* there is no trace in the fossil.

Two forms of tibia present themselves, one (with three examples) much less unlike that of *P. platyrhinus* than the other, but, nevertheless, to be preferred for reference to *P. mitchelli*, for though unexpectedly thin and angular it is much less so than its companion. With extremities no greater in size, the fossil of this form is in its total length distinctly (one-twelfth) greater than in recent bones. Compared with the humerus it must, therefore, be considered slender. In general shape it is like that of *platyrhinus*, but its shaft has a little stronger curve and a rather greater dilatation of its edge at the junction of the proximal and middle third of its length. The posterior surface of the shaft is broader and flatter and its edges, but especially the distal half of the inner edge, are sharply angular. The cavity for the outer condyle of the femur is, unlike that of *platyrhinus*, circular, the space between it and the procnemial tuberosity much more elevated, causing the articulating part of the head, when viewed laterally, to appear much longer; the tuberosity is shorter, the inner edge of the entocondylar surface is not produced into a point adjacent to the facet for the head of the fibula, and the spine is both higher and sharper. At the distal end the anterior edge of the shaft is more compressed, the scaphoid moiety of the inner malleolus is narrower and more sharply grooved off from the rest of the malleolus. Perhaps no one of the several differences which have been noticed would be sufficient of itself to distinguish this tibia from others, but, taken together, the discrepancies between it and that of *platyrhinus* are altogether prohibitory of specific identity between the two. Of this bone the collection contains one nearly perfect from the right side and two opposite halves from the left side.

Until it can be shown that the fossils which have been brought forward are not really bones of *P. mitchelli*, that is until genuine bones of *P. platyrhinus* are found fossil on the Condamine, or until another species of extinct wombat to which they can more probably be referred becomes known, it may, I think, be accepted

as a proved fact that *P. mitchelli* is not synonymous with *P. platyrhinus*. Against this it will be urged that naturalists of approved sagacity and wide experience have seen reason to come to the opposite conclusion. That they have done so is not at all surprising. There is no difficulty in believing that there is, on the whole, sufficient resemblance in cranial and dental characters to lead observers who were compelled to trust to those characters alone to the decision they have announced. But it is questionable whether we ought to trust to them alone so implicitly as to pronounce an unreserved opinion in cases where material is scanty, specialization feeble and apt to be obscured by the accidents of burial, and where the question is between a living animal and a companion of extinct species. The present is not the first experience which has convinced me that such a course may lead to error.

P. mitchelli is, however, not the only wombat of its size which found burial in the Darling Downs deposits, though the only one to which the bones already noticed could have belonged. There was a species distinguishable almost at a glance by the narrowness of its teeth, which are intermediate in breadth between those of *P. parvus* and *P. mitchelli*, though serially as long as or longer than in the latter species. As a marked reduction in the width of the teeth has not been noted in the descriptions of known species, and as the teeth in all the mandibles of *P. mitchelli* are appreciably the same in width, I must perforce regard this narrow-toothed wombat as a new species, for which the name *angustidens* may be appropriate.

Mandibular characters:—Teeth narrow, in a relatively long series; posterior molars oblique; premolar large, subrectangular, with its long axis in the axis of the jaw; symphysis rather short.

The species is founded on four mandibular specimens, two of them from the same mandible. The more perfect of the latter shows the whole of the dentary limb from the incisor outlet to the base of the coronoid process with all the teeth except the incisor in place. The length of the molar series is 52·5 mm., in an

average jaw of *mitchelli* it is 51; the width of m^3 is 6·8 mm., against 7·8 in *mitchelli*, the difference of a millimetre throughout the series asserting itself plainly to the eye. The premolar is unusually large and unusually rectilinear in form; the midline of its flat inner side is sharply impressed with a vertical groove, and its longitudinal axis is all but coincident with the longitudinal axis of the alveolar series. The lobes of m^1 are as usual nearly at right angles to the line of teeth, those of m^2 are distinctly oblique, of m^3 more so, and of m^4 still more so. The lower contour of the jaw is flatly arched, being rather the deepest in the middle and not less deep beneath p^4 than under m^4—it approaches that of *platyrhinus* and differs much from that of *mitchelli*. The coronoid process is, at its base, more than usually exserted from the side of the jaw, is thick and massive, and has on its anterior edge a peculiar character, a series of short, strong, oblique ridges. The symphysis in this mandible extends only to the middle of m^1, but its condition shows that anchylosis with its fellow had hardly begun, and that, consequently, its shortness is attributable to its youth, notwithstanding that m^4 is worn down to smooth surfaces. The depth of the jaw opposite m^1 is 38, that of *P. platyrhinus* being 32·5.

The associated limb is but a fragment with the four true molars in place and affords no further information. The third example is a right dentary limb, containing m^1, m^2, m^3, and half of m^4, the teeth being equally narrow and oblique posteriorly. The symphysis in this example extends to the hinder lobe of m^2. The fourth subject is similar to the last, but contains only m^1, m^2, and m^3. The symphysis is indistinct, but appears to have extended to the fore lobe of m^1. The teeth are similar in width and obliquity.

Fortunately the existence of this species is affirmed by other than mandibular testimony. Inferring from the narrowness of its teeth that *angustidens*, though equal in size to *mitchelli*, was more delicate in structure, I refer to it a nearly perfect humerus and a tibia which convey the same impression. The humerus differs generally from that of *mitchelli* in its comparative slenderness, and,

indeed, exceeds in this respect that of *platyrhinus*; it is 124·5 mm. long, and would be of exactly the same length as in *platyrhinus* but for an elongation of the ectotuberosity; both the breadth of the proximal end and the length of the condyles are as they are in the living species, the teretotriceps ridge is of the same extent and form. The head is a little and the great tuberosity much narrower, the latter is altogether different in shape from that of *mitchelli* and *platyrhinus* both, it rises high above the level of the head as an obtusely pointed backwardly inclined peak separated from the neck by a low transverse ridge. The facet on its posterior aspect is larger than in *platyrhinus* but less defined, and in the middle of its length it is more deeply impressed. The lesser tuberosity is, on the other hand, much less elevated, and is more distinctly connected with the greater by the tumid edge of the anterior surface of the shaft. On this aspect the greater tuberosity is much less convex than in other species. The pectoral ridge is not quite so distinctly continuous with the greater tuberosity as in *P. mitchelli*, but it is higher and at its distal end forms a larger and better defined tubercle. As in *P. mitchelli* the deltoid ridge terminates in a retroflected angle, but one of greater expansion. The prominence on the long oblique edge joining the ends of the two ridges is much larger and sharper, and from it a thread-like ridge, a rudimentary predeltoid, runs proximad for a few millimetres. The breadth of the shaft at its proximal third is 22½ mm.; at this point it is but 12·8 in antero-posterior thickness against 14·5 in *platyrhinus* and 17·5 in *mitchelli*. The length of the shaft from the convex edge between the tuberosities to the end of the pectoral ridge is 61·5 mm., in *platyrhinus* it is 59, and in *mitchelli* 55. As in *mitchelli*, the posterior limit of the head descends low and angularly upon the shaft, overhanging it more than in the stouter bone. The ridge for the humeral head of the triceps is wanting, or it may be represented by a very small prominence near the edge of the shaft. The anconal and coronal pits of the distal end have a large foramen in common. The condyles are narrow antero-posteriorly, the intercondylar rotular surface remarkably so. The outer condyle is almost perfectly globose.

The tibia, like the humerus, is unusually thin and angular. It its within two millimetres of the same length as that of *platyrhinus*, but in general form it most resembles that of *latifrons*, the curve of the shaft and more especially the dilatation of its anterior edge between the proximal and middle thirds being rather pronounced. The concave area beneath the popliteal notch is deeply excavated. The proximal end of the hinder side of the shaft is broader, the distal end of this surface narrower than in *platyrhinus* and its edges are sharper, as, indeed, are most of the edges of the bone. The distal articulation is reniform in shape, not, as usual, rhomboid ; the articulating surface for the astragalus is elongated posteriorly, and is more distinct from the shaft than in *platyrhinus* , the inner malleolus is longer, and its scaphoid facet comparatively small. In short, a wombat tibia could hardly present more specific differences from the tibias of *mitchelli* and *platyrhinus* than does this bone.

We have thus two species of *Phascolomys* of co-equal size represented by limb bones as well as dental remains from the Darling Downs. Not one of these bones can, without violence to common sense, be identified with bones of *platyrhinus*. It would be absurd to deny that any of them belong to the common species of the period, *P. mitchelli*. The inference is irresistible that *P. mitchelli* and *P. platyrhinus* are distinct species.

It is a conclusion which is supported by a fine series of mandibles of *P. mitchelli* in the Queensland collection.

DESCRIPTION OF A NEW MARINE SHELL.

By C. Hedley and C. T. Musson.

(Plate xix., figs. 1-3.)

Eulimella moniliforme, n.sp.

Shell minute, thin, transparent, acicular, conical, with a small half turned over discoidal sinistral tip, whorls rounded, suture margined, deeply impressed; sculpture fine longitudinal striæ crossed by faint microscopic spiral scratches; colour glossy white; spire long, tapering slowly; whorls, besides those of the embryo, 7, rounded, increasing slowly, last constituting two-thirds of total length; mouth long, pear-shaped, rounded below and acute above; inner lip thick, defined, straight, reflected anteriorly over a minute rimation; outer lip sharp.

Length 3, breadth 1 mm.

The nearest ally of our new species appears to be *E. laxa*, Boog-Watson (Challenger Reports, Zoology, Vol. xv., p. 497, pl. 33, fig. 6), which it resembles in its rounded whorls and pear-shaped mouth, characters in which it differs from others of the genus. Some specimens have more swollen whorls than others; possibly this is a sexual feature. We collected this shell in the brackish water of Manly Lagoon, near Sydney; entangled in masses of flannel-weed (*Spirogyra*) these tiny molluscs were seen in abundance. This lagoon is separated from the ocean by a narrow sandbank thrown across the mouth of a small stream; during floods and storms this barrier is broken down and free communication then exists between the pond and the sea.

Type specimens have been deposited in the Australian Museum.

NOTES AND EXHIBITS.

Mr. Hedley submitted the following "Note on the Ova of *Helicarion robustus*, Gould."

"My attention was lately drawn by my observant friend Mr. Fletcher to the egg-capsules of *Helicarion robustus*, Gould. No account of these has appeared in print, and it may be advisable to place on record a short description. Near Sutherland railway station, a few miles south of Sydney, these ova were so plentiful the first week in April that scarcely a stone, log or other suitable shelter was raised without revealing one or more masses of eggs. Mr. Fletcher tells me that he has noted their occurrence in previous years in the months of June (1887), January (1888) and April (1890), after rain. They are deposited either on the earth or adhering to the lower surface of the shelter, usually 12 to 20, and occasionally 40, in a bunch, each individual with the fluted hemisphere outwards. A single egg measures about 4 mm. major and 3 mm. minor axis; soft, gelatinous, white when fresh laid, growing yellow as it matures, probably because the embryo is then showing through the semi transparent wall, ovate, acuminate at one end, from the acuminate pole nine spiral ribs descend to the periphery, where they gradually vanish. The infant mollusc pierces the egg wall near the apex formed by the conjunction of the ribs, and on hatching possesses a shell of one and a-half whorls quite resembling the adult except in size."

Mr. Maiden exhibited ripe fruits of *Monstera deliciosa* grown at North Sydney by Mr. J. Malbon Thompson, who believes that this is the first time that these fruits have fully ripened in Sydney. They were fifteen months in ripening after the fruit had set.

Also, specimens of the "vegetable sponge," *Luffa aegyptiaca*, grown by Mr. James Hurst at Summer Hill; and an abnormal growth of maize cobs, from Bathurst.

Mr. A. Sidney Olliff exhibited (1) two species of a small fly (*Diplosis* spp.), recently bred at the Department of Agriculture by Dr. Cobb and himself from larvæ found feeding on rust (*Puccinia*) on peach and sunflowers; (2) a drawing of a larva of one of these flies, illustrating the anatomy of the animal, and exhibiting the embryo and larva of an internal parasite, apparently belonging to the Hymenoptera; and (3) specimens of a dipteron (*Tachina* sp.), a parasite of the plague locust, *Pachytylus australis*, Br., which is allied to the recently-discovered *Masicera pachytylis* Sk.

Mr. P. N. Trebeck showed some insects collected at North Sydney.

Mr. Henry Deane exhibited a fine specimen of *Ophideres saliminia*, Cr., from Casino, a moth which enlarges, by means of its auger-like proboscis, the holes made by fruit-flies, &c., in the rind of oranges and bananas.

Mr. Deane also stated that last month, while travelling by night through the Big Scrub in the Richmond River District, his interest was aroused by the remarkable effect produced by luminous insects which abounded by the roadside. Specimens were secured and sent off in the hope that they would arrive in time to be exhibited at last month's meeting, but they came a day too late, and in the meanwhile have died. From their general resemblance to the larvæ of *Ceroplatus mastersi*, Sk., which are also phosphorescent, Mr. Fletcher, who had seen the specimens forwarded, was of the opinion that these were very probably also dipterous larvæ.

Mr. David made some remarks on certain luminous organisms which he had observed in old coal mine workings in Illawarra, the identification of which it was hoped would not long be postponed.

WEDNESDAY, 24TH JUNE, 1891.

The President, Professor Haswell, M.A., D.Sc., in the Chair.

DONATIONS.

"Société Botanique de Lyon.—Bulletin Trimestriel" (1889). No. 4. *From the Society*

"Verhandlungen der Gesellschaft fur Erdkunde zu Berlin." Bd. xviii., Nos. 2 and 3 (1891). *From the Society.*

"Bulletin de la Société Belge de Microscopie." xvii^{me} Année, No. 5 (1891). *From the Society.*

"American Naturalist." Vol. xxv., Nos. 290 and 291 (Feb. and March, 1891). *From the Editors.*

"Bulletin of the American Geographical Society." Vol. xxii., Supplement; Vol. xxiii., No. 1 (March, 1891). *From the Society.*

"Zoologischer Anzeiger." xiv. Jahrg., Nos. 361-363 (April-May, 1891). *From the Editor.*

"Journal of Comparative Medicine and Veterinary Archives." Vol. xii., Nos. 4 and 5 (April May, 1891). *From the Editor.*

"Journal of the Royal Microscopical Society, 1891." Part 2 (April). *From the Society.*

"Perak Government Gazette." Index to Vol. iii. (Jan.-Dec., 1890), Vol. iv., Nos. 8-12 (April-May, 1891). *From the Government Secretary.*

"Annalen des K. K. Naturhistorischen Hofmuseums, Wien." Band v., Nos. 1-4 (1890). *From the Director.*

[redacted]

"Videnskabelige Meddelelser fra den naturhistoriske Forening i Kjobenhavn for Aaret 1890." *From the Society.*

"The Canadian Record of Science." Vol. iv., No. 5 (1891). *From the Society.*

"Agricultural Gazette of N.S.W." Vol. ii., Part 4 (April, 1891). *From the Director of Agriculture.*

"Report on the Chillagoe and Koorboora Mining Districts (1891)." By R. L. Jack, Government Geologist, Queensland. *From the Author.*

"Department of Mines, Sydney—Palæontology. No. 5—A Monograph of the Carboniferous and Permo-Carboniferous Invertebrata of N.S.W. Part i.—Cœlenterata." By R. Etheridge, Junr. *From the Hon. the Minister for Mines.*

"Mémoires et Publications de la Société des Sciences, des Arts and des Lettres du Hainaut." v^{me} Série. T. ii. and iii. (1889-90). *From the Society.*

"Zoological Society of London—Abstract." April 21st, 1891. *From the Society.*

"Proceedings of the Royal Physical Society of Edinburgh (1889-90)." Vol. x., Part 2. *From the Society.*

"Journal of the Bombay Natural History Society." Vol. v., No. 4 (1890). *From the Society.*

"Reichenbachia.—Orchids illustrated and described." By F. Sander. Second Series. Vol. i. Part 4; "Stettiner Entomologische Zeitung." 51 Jahrg., Nos. 7-12 (1890). *From the Hon. Sir William Macleay, F.L.S., M.L.C.*

"Archives Néerlandaises des Sciences Exactes et Naturelles." T. xxv., 1re Livraison. *From the Dutch Society of Sciences at Haarlem.*

"Reports and Statistics of the Mining Department of Victoria for the quarter ended 31st March, 1891." *From the Secretary for Mines.*

"Report of the Manchester Museum, Owens College, 1889-90." *From the Keeper of the Museum.*

"Mitteilungen des Vereins für Erdkunde zu Leipzig, 1890." *From the Society.*

"Australasian Journal of Pharmacy." Vol. vi., No. 66 (June, 1891). *From the Editor.*

"The Pharmaceutical Journal of Australasia." Vol. iv., No. 6, (June, 1891). *From the Editor.*

"Transactions of the Connecticut Academy of Arts and Sciences." Vol. viii., Part 1 (1890). *From the Society.*

"Proceedings of the United States National Museum." Vol. xiii. (1891), Nos. 834, 835, 837, 839. *From the Director.*

"Bulletin of the Museum of Comparative Zoology at Harvard College." Vol. xxi., No. 1. *From the Curator.*

"United States Department of Agriculture—Division of Entomology Bulletin," No. 24 (1891); "Insect Life." Vol. iii., Nos. 7 and 8 (April, 1891). *From the Secretary of Agriculture.*

"Zoological Society of Philadelphia — Nineteenth Annual Report." *From the Society.*

"Geological Survey of Canada — Contributions to Canadian Palæontology." Vol iii. (4to), No. 1 (1891). *From the Director.*

"Geological Survey of India—Memoirs." Vol. xxiv., Part 3; "Records." Vol. xxiv, Part 1. "Contents and Index of Vols. i. xxi. of the Records (1868-87)." *From the Director.*

"Journal of the College of Science, Imperial University of Japan." Vol. iv., Part 1. *From the Director.*

"The Quarterly Journal of the Geological Society." Vol. xlvii., Part 2 (1891). *From the Society.*

"Johns Hopkins University Circulars." Vol. x., Nos. 87 and 88 (April-May, 1891). *From the University.*

[redacted]

PAPERS READ.

ANGOPHORA KINO.

By J. H. Maiden, F.C.S., F.L.S.

The importance of the genus *Eucalyptus* and the almost universal occurrence of kino in these trees has thrown the subject of kino in the closely related genus *Angophora* almost entirely into the shade. Although some species are very common and yield it abundantly, a prejudice might arise against *Angophora* kinos being officially recognised as substitutes for that of *Pterocarpus*, partly because an odour is inadmissible in this substance. If a use should be found for them, I believe the kinos of any of the species may be mixed without detriment, as they appear to have practically the same composition when gathered under similar circumstances.

Angophoras are confined to the east coast of Australia; they are five in number, four of them being found in New South Wales, while one, *A. Woodsiana*, is peculiar to Queensland. *A. cordifolia* is peculiar to New South Wales; *A. intermedia* has the widest range, extending from Victoria to Queensland. *A. lanceolata* and *A. subvelutina* are found in Queensland as well as in New South Wales. They are all well known as "apple trees" (although some species have other names in addition).

The timber yielded by various species of *Angophora* is often much deteriorated by "gum-veins" consisting of kino, which is usually disposed in thin concentric circles, but also in pockets. It is, nevertheless, useful for wheelwrights' purposes and for fuel.

Angophora cordifolia, Cav., is a coast district tall shrub; I have not observed kino on it.

Angophora subvelutina, F.v.M. This is a fair-sized tree; kino has likewise not been recorded from this species, but this is doubtless because attention has not been drawn to the matter.

Angophora Woodsiana, Bail., (Syn. Queensland Flora, Bailey): "Often containing large quantities of liquid red gum (kino) in hollows of the timber like the bloodwood (*Eucalyptus corymbosa*, Sm.)" (Bailey); used by the settlers as a remedy in diarrhœa according to Dr. J. Bancroft.

Angophora intermedia, DC. This is the species (and also *A. lanceolata* to a less extent) which yields a watery, slightly astringent liquid when the trunk (particularly at swellings) is tapped. I have described this substance under the name of "liquid kino" in a paper, *Proc. R. S. Victoria*, 1889, p. 82. It is sometimes known as "cider," and it is worthy of note that some country people call all liquids obtained from our native trees "cider," whether they are drinkable or not.

A. intermedia forms a fine tree, perhaps the handsomest of the genus. The bark is fibrous, hence the kino gets entangled in it and is frequently wasted. I describe four specimens of its kino, illustrating the variability of its appearance and composition.

1. From Colombo (Lyttelton), near Candelo, N.S.W., gathered in June. Height of tree 30-50 ft., diam. 2-4 ft.

This kino had evidently exuded some time when collected. It is of a reddish brown colour, and of a brittle nature. From this [illegible] small masses in which it is obtained speedily [illegible] a colour very like [illegible]

2. Bangley Creek, near Cambewarra, collected in March, from trees in diam. 1-2 ft.

This is obviously a fresher sample than *A. intermedia* No. 1. It is so like *A. lanceolata* No. 2 as scarcely to be distinguished from it in bulk. In water its behaviour is similar to that of the preceding sample, but the solution is of a pale orange colour.

3. A second sample from Bangley Creek, Cambewarra, collected in April, from trees height 60-80 ft., diam. 1-3 ft.

It is a very clean sample, is neither perfectly new nor very old, is in smallish pieces, and of a garnet colour. On account of its friability, it can be reduced to a light orange powder between the fingers without much difficulty. The kino in bulk has a slightly dulled appearance, although individual fragments break with a bright fracture.

4. From Eastwood, near Sydney, collected in April, from trees height 80 ft., diam. 2 ft.

This sample much resembles No. 2. It is, however, decidedly darker in bulk, even inclining to liver-colour, and is somewhat opaque. It readily crushes between the fingers to a burnt sienna powder, slightly darker than the standard tint. It is evidently the oldest of the *A. intermedia* samples. To water it yields a rich orange-brown liquid when filtered. With alcohol the filtrate is of a dark orange-brown.

Angophora lanceolata, Cav. "Red Gum," "Orange Gum," "Rusty Gum."

In collecting kino from this tree it may be well to remind people that the smooth trunk might perhaps be mistaken by a careless observer for that of *Eucalyptus maculata*, but the two kinos cannot be confused even by a tyro. I submit notes on two kinos of this species. This kino is abundant, and readily gathered on account of the smoothness of the bark. The tree obtains its vernacular names owing to the kino stains on the pale-coloured stem.

1. From Botany, near Sydney, collected in March, trees 50 ft high, and 1 to 2 feet in diameter. When freshly gathered this kino has a smell somewhat like sour wine, something resembling that of *E. maculata* but not so agreeable. As far as my experience goes it is quite characteristic. The two kinos possess other characteristics in common, one of which is the following. If they be digested in water, and the turbid liquid be treated with ether, two ethereal layers are formed, containing catechin in solution. This substance may readily be obtained by evaporation of the ether, and it possesses the characteristic odour of the kino from which it was obtained, the residue insoluble in ether being quite destitute of odour. The odoriferous principle (a volatile substance allied to cinnamene or styrol) is, however, so small that an hour's exposure of the ethereal extract to the atmosphere removes every trace of it.

The present sample had freshly exuded, is exceedingly brittle, has a bright fracture, ruby with a tinge of brown; colour of powder orange brown. So brittle is it that the lumps and vessels containing it become readily coated with fine powder.

In cold water it dissolves slowly, forming a liquid of the colour of brown sherry if left undisturbed. With alcohol it yields a pale orange-brown solution with a slightly muddy residue.

2. The Valley, Blue Mountains, N.S.W., collected in April, height 80-150 ft., diam. 1-2 ft.

The description of No. 1 will apply here with the following exceptions. In bulk it is hardly so red as No. 1, while its powder is of a dark buff colour. To cold water it behaves in the same way as No. 1; it is, however, less turbid and lighter in colour. With alcohol it yields a pale orange-brown solution.

The following table shows the composition of the kinos described in this paper, and I may observe that Angophora kinos would (if Eucalypts) be placed in my "Turbid Group."

ANGOPHORA KINO.

	Intermedia.				Lanceolata.	
	No. 1.	No. 2.	No. 3.	No. 4.	No. 1.	No. 2.
Catechin and Tannic Acid ...	77·1	79·0	84·2	81·98	83·0	83·75
Aromatic substance, (?) Cinnamene (Styrol)	......	......	......	......	traces	traces
Ligneous matter and other impurities	4·4	4·2	·6	·72	·4	·8
Moisture	16·8	14·7	15·1	16·6	16·5	15·35
Ash	1·7	2·1	·1	·7	·1	·1
	100·0	100·0	100·0	100·00	100·0	100·00
Tannic Acid (Löwenthal) ...	52·32	57·4	59·43	53·84	55·37	50·3

The catechin and tannic acid in these kinos were determined together by extraction with alcohol. The tannic acid was separately determined by Löwenthal's process, on an original aqueous solution, and the catechin estimated by difference.

THE INCISORS OF *SCEPARNODON.*

BY C. W. DE VIS, M.A., CORR. MEM.

(Plate xxii.)

The haze of ignorance still shrouding the origin of the teeth we call *Sceparnodon* would be lightly lifted if only we could opine with the author of Pt. 5 of the British Museum Catalogue of Fossil Mammals, that they grew in the upper jaw of *Phascolonus*. But even in the realm of the undemonstrable it would be well that an explanation to be projected thence should not wholly ignore the fact, intimated by Owen, that these teeth are not all the same teeth ; well, also, that it should not, in the act of associating them with any mammal whatever, raise a crop of difficulties for other explanations to eradicate. To a waiter on reliable means of judgment it has now become evident that any attempt to refer these teeth to an animal whose lower incisor is known must end in disaster. In other words, it is patent that the teeth in our collections are not all, as they are assumed to be, upper incisors, but that they include the teeth from both jaws of the otherwise unknown animal. Though the assertion is a bold one, it is made with the diffidence which arises, not from any weakness in the evidence, but from the reflection that the means of distinguishing one tooth from the other has always been in view of keen and practised eyes yet has never been recognised. Turning to Plate 11 of the Philosophical Transactions of London for 1884, and comparing fig. 5 with fig. 7, we observe that the length of the working surface in fig. 7, though diminished by the absence of somewhat

more than the cutting edge, is very much greater than, in fact nearly twice as great as, that of fig. 5. We are not at liberty to attribute so great a difference to the accidents of function in two individuals or to specific differentiation until we have failed to explain it by reference to any known rule applicable to the case, and such a rule we find maintained in the conditions of the working surfaces by all marsupial herbivores having procumbent incisors in the lower jaw; in these the long slope of the lower tooth working with reciprocating action across the comparatively vertical edge of the upper suffers abrasion to the extent of its motion. Seen in this light, the significance of the relative lengths of the surfaces of abrasion in the teeth figured becomes great, and it points to no other interpretation so likely to be correct as this, that they are due to the interaction of opposed teeth. The inferiority in the width of the tooth, which from this point of view is the upper, affords no ground of objection since this is simply a sign of immaturity; the tooth is, as Owen rightly inferred from its shape, in course of growth. On the supposition then that this identification of the lower incisor is admissible, the long mid-rib on its concave side, in which its describer is disposed to see an indication of specific difference, becomes merely an item, but an important one, in its diagnosis.

So far we have deduced all we can, and all that is really necessary, from the only figures of the teeth extant, and very probably it is not enough to make good our contention. But evidence in reserve shows, first, that the subject of fig. 5 is really an upper tooth; secondly, that the characters presented by fig. 7, length of working surface, the longitudinal rib, even a peculiarity in the depression marked *b* are constant, and, therefore, as to this tooth, we shall have to choose between the probability of its being the lower tooth of *S. ramsayi*, and the improbability that it is from a

second species whose upper tooth is constantly abraded to an extraordinary degree, the lower tooth in both species being unknown.

The Queensland Museum possesses a perfect adult incisor of large size (Pl. xxii. fig. 1); that this is, without shadow of doubt, an upper tooth is certified by the presence of the premaxillary bone which encases it to a distance of 41 mm. from its outlet, and re-appears distad as a smaller adherent portion from the root end of the socket. In passing it may be noted that the outer edge of the premaxilla, commencing near the outlet, folds over inwards and downwards, also that its inner edge (17 mm. in length) is smooth and entire, showing no sign of sutural union with its fellow, both features foreign to the near kindred of *Phascolonus*. The working surface of this tooth has the same general length as that in Owen's fig. 5, namely, 13·5 mm. The entire breadth of the tooth being 40 mm., or three-eighths greater than that of its younger type, we may gather that the working surface did not, on the whole, lengthen with age, a fact directly opposed to the assumption that the elongately worn teeth are from the same seat of growth, and at the same time rather discouraging than otherwise any suspicion that they may have belonged to another species. On the concave side of this tooth there is not the slightest trace of a median longitudinal ridge. Assuming for a moment that the subject of fig. 7 is a cast of a lower tooth, its breadth, 35 mm., is fairly proportionate to that from the upper jaw, 40 mm.

The upper tooth being ascertained and its characters definable, we have to account for those *Sceparnodon* incisors which are not at all in accordance with it. And here the writer must take leave to confess that, until the last piece of evidence fell into his hands, he, relying on authority, failed to appreciate the differential characters of the teeth and casts under his own observation. His attention to the matter was aroused by the appearance of the

small tooth shown in Pl. xxii. fig. 2, a tooth in a much less advanced stage of growth than that of Owen's fig. 5, and so distinctly different from the adult tooth now figured as to excite a doubt in his own mind as to their specific co-identity. The doubt vanished as soon as the relative extents of their working surfaces suggested community of causation between them and similar effects elsewhere. The length of this surface in the young tooth is 31 mm., more than twice its length in the adult upper tooth, but considerably less than in the adult lower tooth represented by Owen, fig. 7. But the breadth of the tooth itself at the fore end is but 16 mm. against 35 mm. in the type adult, so that its working surface is even longer in proportion to its width than in the adult state. The identity of this tooth with Owen's subject, fig. 7, is established by the presence of the longitudinal rib, and the constancy of this character again is deduced from a third appearance of it in Owen's fig. 2. In the depression *b* of fig. 7, and of Pl. xxii. fig. 2, *infra*, we have a proof of equal persistency. One side of the abraded surface (the left) sends backwards, as is shown in the figures, a tapering tongue which ends in a point depressed in the outer edge of this face of the tooth, and more than half of the surface of wear on the inner side loses its smooth flat character posteriorly and becomes a coarsely roughened depression which in the young tooth is seen to be caused by the direct chopping impact of the sharp edge of the upper tooth on its surface, in which it has cut distinct notches. A similar depression, accompanying a lateral tongue of abraded surface on the opposite side, occurs in the immature upper tooth as figured by Owen, but the depression there is small, smooth and limited to the edge; the surface, moreover, has no trace of incisive action behind the regular surface of wear. There are thus three features constantly present in these teeth which are absent from the others, and one of these features, an extended area of abrasion, is normal to the lower incisors of other marsupials. The differently conditioned teeth prove to be upper teeth. The plain

inference is that their companions are the corresponding lower teeth.

The inference can only be evaded by attributing them to another species. To effect this we shall have to suppose either that we know only the upper teeth of one species and the lower of another, a supposition which its responsible originator will have to recommend by the doctrine of chances, or that the second species had abnormally long working surfaces on its upper incisors and correspondingly enormous elongations of those surfaces on the lower incisors. The probability of this condition of things it is hardly necessary to discuss.

It must be concluded that both the upper and lower incisors of *Sceparnodon* are known, and, consequently, that *Sceparnodon* is not a synonym of *Phascolonus*.

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CONTRIBUTIONS TO A MORE EXACT KNOWLEDGE OF THE GEOGRAPHICAL DISTRIBUTION OF AUSTRALIAN BATRACHIA. No. II.

By J. J. Fletcher.

In this second small contribution I am able to supply some supplementary details of interest, to record several additional collections from localities in New South Wales west of the Dividing Range—as well as two from Victoria; and to give some interesting facts kindly communicated to me by two of our members, about the habits of several inland species which town residents rarely get the chance of observing in the natural haunts. Though the number of species (eighteen) previously recorded from the inland division of the colony is not increased, the particulars now given offer additional evidence of wide distribution.

(i.) *The Coastal Division of N.S.W. (East of the Dividing Range).*

(a *bis*). From Dunoon, Richmond River (collected by R. Helms).

Hyla phyllochroa, Gthr. *Hyla gracilenta*, Ptrs.

During a second visit to Dunoon, early in this year, Mr. R. Helms obtained and kindly forwarded to me alive one example of the former, and a number of specimens of the latter, both additions to the fauna of the district, and the second of them to New South Wales as well, the species having been previously recorded only from Queensland (N. E. Australia and Port Bowen by Peters; Rockhampton, in B. M. Catalogue; specimens obtained for the Macleay Museum by Mr. Froggatt at Cairns were exhibited at a Meeting of this Society in August, 1886). About the same time Mr. A. Sidney Olliff kindly handed over to me two specimens of

the same species from Grafton, collected and forwarded by the Right Rev. the Bishop of Grafton.

H. gracilenta appears to be another example of species like *Chiroleptes australis* and others whose stronghold according to present knowledge is Queensland, and which find their southern limit somewhere about the northern boundary of New South Wales. It is a very beautiful frog when alive; the iris has an inner portion golden shading into a circumferential ring of bright coppery red (visible sometimes even in spirit specimens); the body above green or yellowish-green; in the males the throat, part of upper arm, shoulders, a line along the flanks bright yellow; the under surface of the body and limbs tinged with yellow; the back of thighs purplish. The "white line on canthus rostralis, outer border of upper eyelid, and above the tympanum" of Mr. Boulenger's description is absent in my specimens.

Mr. Helms says "this species may almost be called arboreal; most of the specimens were found on the leaves of the arrow root plant; during the day time they sit quite still with their eyes closed, probably asleep; when kept in the dark they assume a much darker colour." I kept some specimens alive for some time in a vivarium along with specimens of *H. cœrulea*; individuals of both species during the day time were invariably asleep, either perched on the leaves of an Arum, or adhering to the sides of the vivarium—to glass or wood indifferently.

(d *bis*). From the Blue Mts.

Hyla aurea.

Four specimens of this species were found by me last month near Springwood, the first time I have happened to meet with it on the Blue Mts. In the same locality in December last Mr. Sloane and myself found two couples of *H. citropus* in cop., in a little pool overshadowed by a fallen tree-trunk in a gully. This is the first time I have seen this species from anywhere on the Blue Mts., except Mt. Wilson.

[redacted]

(ii.) *The inland division of N.S.W. (West of the Dividing Range).*

(m) From Goangra and Euroka, near Walgett on the Namoi (collected by Messrs. A. Carson, and J. H. Rose).

Limnodynastes salminii	*Hyla cærulea*
Chiroleptes platycephalus	*peronii*

Living specimens of all the above were exhibited at the Society's Meetings in February and March last. As I then pointed out, the stripes on the back which in spirit specimens of *L. salminii* are pink or rose-red were in the living animals of quite a different tint, a bright ochreous-yellow; when put into spirit subsequently the colour soon changed, the glandular fold from the eye to the shoulder, and a patch on each upper arm also assuming the rosy tint, as well as part of the upper eyelids. *Notaden* also occurs in the Walgett district, but specimens did not happen to be procurable at the time the others were forwarded. Mr. Rose has very kindly furnished me with the following particulars about this species.

"*Notaden bennettii*, the 'Catholic frog' or, as I have heard it called, the 'Holy Cross toad' I first noticed in January, 1885, after a heavy fall of rain lasting ten days, off and on, and succeeding a long and severe drought. I was living at that time on the Merri Merri Creek, 36 miles from Coonamble. These toads were then very plentiful, and seemed to come out of the earth. I have seen them all over the plain country, both on black and sandy soil. Here at Euroka I have dug them out of a soft loamy flower bed in front of the house at a time when the earth was commencing to get dry; during comparatively dry periods they disappear, but reappear as soon as a few points of rain have fallen. I can safely say they were to be found here at all times during the last twelve months, though at times during the hottest part of summer only under logs and in damp places. After a heavy fall of rain in summer they simply swarm. I should certainly incline to the opinion that it is always about if not too dry. I have seen it as far south as Forbes. Some that I have seen have

been very much lighter in colour than others; one could truthfully have called them yellow. They hop along with short quick strokes; and if teased or interfered with will stand up with bodies above the ground on all fours, and puffing themselves out to an absurd size will face their tormentor in a defiant manner."

"I can verify the statement of your correspondent that *Notaden* is partial to ants, for I have repeatedly unearthed them, and fed them upon the wood-destroying white ants, which they ate in large quantities refusing however any that were dead. I also tried them with the carrion ants, giving them eggs, pupæ, workers, and winged ones. The last-mentioned were soon disposed of, the eggs and pupæ taken into the mouth and ejected, but the workers they refused to touch. I tried them with other food such as insects, grubs, &c., but did not observe them to eat any. Perhaps their partiality for white ants explains their being frequently plentiful about homesteads, deserted yards, and buildings."

As further confirmation of the fact that *Notaden* preys upon ants, I may say that the bottle in which eleven living specimens were forwarded to me from Trangie, as noted below, by the Rev. J. M. Curran, F.G.S., contained on opening a noticeable quantity of undigested fragments of ants voided by the toads while in transit.

Mr. Curran has also very kindly furnished me with the following observations:—"On two occasions recently I have noticed large numbers of 'Hervy's frog' (*Notaden bennettii*) on the Macquarie River, about four miles down stream from the locality known as the Macquarie Cataract. On each occasion there had been recent rather heavy rains. Before the rain no frogs were visible, but after a downpour of five hours the frogs appeared in thousands. On Monday, January 26th, 1891, I rode from the Macquarie to the Ewenmar Creek, and for some twelve miles of well-grassed country a dozen specimens could have been easily collected at any one place over the whole distance. Tuesday was fine, and on the return journey I did not see a single specimen. I noticed the same frogs plentiful in November, 1890, about

Tenandra also after rain. The settlers say that it was just seven years before that the frogs were seen in such large numbers. I heard on good authority that the blacks used to use these frogs for food. I myself saw an old gin seemingly enjoy as a dainty morsel the muscular thighs of the frog, eating them quite raw with a little salt. They are called Hervy's frog from a fanciful resemblance of the pattern on the creature's back to the letter H, this being Mr. Hervy's sheep brand."

Notaden when alive is a batrachian of quaint and striking appearance; immersion in spirits, however, very soon produces a washed-out effect, the bright tints (yellow, red, and green) being entirely discharged or much bleached; ordinary spirit specimens thus quite fail to suggest, or at least in the forcible manner which the examination of the living animal almost immediately does, that *Notaden* is probably an example of "warning coloration" not unworthy to rank with Darwin's small Brazilian toad, or Belt's now historic little Nicaraguan frog. The dorsal surface presents a characteristic and very fairly constant pattern which, from the inspection only of spirit specimens, has been described as due to the presence of "a large cross-shaped blackish marking on the back" (Boulenger): or, as Dr. Günther puts it, "a very broad brownish band, marbled with black, along the middle of the back; it bifurcates anteriorly on the head, leaving the forehead greenish, and emits a transverse bar on each side of the back behind the shoulder": this constitutes the cross-pattern to which are due two of the local vernacular names by which the animal is known. In the lumbar region, however, as indicated in fig. 3 of Pl. XXII. of the B. M. Catalogue (2nd edition), the median band emits another transverse band on each side, whence arises the H-pattern referred to in Mr. Curran's remarks, the H being thus placed transversely with regard to the animal's back. Inspection of the living animal at once renders it obvious that the characteristic pattern is not quite satisfactorily expressed in the quotations given above. Rather is it due to an arrangement of very dark (black) not very much raised glandular warts or papillæ of several sizes, together with small isolated spots and patches of ferruginous or orange-red,

and in places white spots, on a greenish background, the pattern being thrown up and emphasised by contrast with sundry symmetrically arranged insular areas free, or almost so, from papillæ, and of a lighter tint, bright yellow or greenish-yellow. The largest warts for the most part outline the pattern, and border the insular patches; there is little more than only an anterior edging of them in the posterior or lumbar limb of the H; the others with the red spots and patches, and in the lumbar band and on the flanks white spots, are scattered over the surface so outlined, from behind the eye downward and outward to the shoulder and along the sides and flanks on each side is another dark band, but with fewer, more scattered and still smaller papillæ, some of them parti coloured - black and white. Thus six areas wholly without warts, or occasionally with a large one here and there, are enclosed, and these, as mentioned above, are of a lighter and yellower tint: two of them are median, an anterior cruciform or dagger-shaped one between and behind the eyes, and a posterior coccygeal narrow band, these two representing the bifurcation of each end—a little extended—of the cross-bar of the H: the others are in pairs, an anterior pair in front of, and a larger posterior pair behind, the anterior limb of the H. The outer surface of the arms and legs, especially the latter are also spotted with red, and the back of the thighs with white on a dark ground.

Looked at in the laboratory, for example in a white dish, *Notaden* is brightly coloured and conspicuously marked; when placed on the grass of the lawn, however, the animal was very much less conspicuous and as long as it kept still even a good observer unaware of its presence and unfamiliar with the animal might, I think, have passed close to it without noticing it. Nevertheless there seems little need to doubt that we have here a case not of *protective*, but of *warning* coloration. The former would probably have been amply provided for as in some green tree-frogs, by a more or less uniform livery of green or greenish-yellow, without the elaborate arrangement of coloured papillæ, and specks, &c., which is present; neither are the grass-lands of the interior quite like well kept city lawns.

Moreover, as implied in Dr. Günther's name, "not only the skin of the paratoid region, but that of the entire back is thickened by numerous glands;" from these there exudes under certain circumstances a copious yellow secretion; Mr. Rose tells me that he has sometimes observed the exudation when handling the toads, and I noticed it in several specimens put into spirit, and also in a specimen which had but recently died. On the supposition that, as in other toads in which such is known to be the case, the glandular secretion is acrid and renders the animal nauseous and inedible (except perhaps to blackfellows who would soon learn to avoid the integument of the part eaten), and taking into account also the animal's habit of puffing itself out when interfered with, and the conspicuous colour and remarkable character of the markings seen at close quarters, it is possible that not many experiments would be necessary to teach snakes, predaceous birds, or maybe some of the larger lizards to grasp the situation. Such an immunity from attack would also render intelligible the unusual habit—unknown as yet in the case of any other Australian frog—of appearing at times in great numbers in the open, and in the day time, without any attempt at concealment, as established on the independent evidence of capable observers. This point, however, I hope to be able to settle at no very distant date by actual experiment.

Of *Chiroleptes platycephalus*, Gthr., Mr. Rose says "this frog is also a burrower; I have found it in a well-formed hollow just large enough to contain the animal comfortably, about one foot underground. I have dug up some scores of them, but I never found any water in the cavities containing them (*i.e.* as Mr. Aitken says is to be found in the clay balls formed by certain frogs in tropical Australia in which they sojourn during droughts); neither is the surrounding earth particularly hard except just in a dry season; just now (May) the walls of the cells are about as hard as potter's clay after the turning-table period, and before being dried. I send you a portion of one of the cavities which contained a specimen of *Chiroleptes*, and from the knife marks you will see that it was not particularly hard when first found."

Mr. Rose kindly forwarded me two lots of living specimens in tins of earth, and I kept them also for some time in a vivarium with a layer of earth on the bottom sufficiently deep to allow them to burrow comfortably out of sight. On turning them out of the tins of earth in which they came they were found snugly ensconced in little chambers below the surface; the soil being clayey it appeared to me as if after having reached the bottom of the tin the frogs, perhaps by puffing themselves out, and by turning themselves round and round, had succeeded in pushing back the earth, and by pressure in puddling the clay to some extent, so forming a little chamber with firm walls, a supposition to which the portion of the chamber sent me by Mr. Rose also lends support. Those kept for some time alive by me were, except for a short time in one solitary instance, not on view during the day time. Partly owing perhaps to nocturnal habits, and partly to burrowing habits, Mr. Rose tells me that he has rarely met with them above ground —once on a wet night, and once in the case of a specimen which fell into a box let into the ground from which it was unable to make its way out. Like *Notaden* it has the habit of puffing itself out when interfered with; and a similar statement is applicable to a specimen of *C. australis* referred to below. In keeping with its retiring habits, *C. platycephalus* is clad in sombre tints, which are not very seriously interfered with by the action of alcohol; my specimens when alive might have been described as above of an olive-grey or greyish brown much freckled with darker spots and blotches, but without any definite pattern, beneath white, the throat of the male slightly and finely dotted with darker.

This may perhaps be the species referred to in a letter to the *Australasian* of date August 2nd, 1890, as occurring on the Paroo, of which the writer says "all those that I saw were found not in, or very near, water, but at from 6-12 inches below the surface of the ground, each in a cavity just large enough to contain it, a great peculiarity being that for several inches all round the earth was caked as hard almost as a brick. Native name of Darling blacks 'cowari.'"

[redacted]

Mr. Boulenger gives as a generic character of *Chiroleptes* "pupil vertical." In the six specimens of *C. platycephalus* already referred to, and in one of *C. australis*, from Herberton, Queensland—some of which were exhibited at the Meetings of this Society in March and April of this year—all examined alive and in a strong light, the pupil was certainly horizontal and not vertical. My determination of the species may of course be incorrect, though taking the other characters into consideration I do not think so.

No doubt most, if not all our frogs, under stress of droughts can or do betake themselves to burrowing when æstivating. This is the case for example with *Pseudophryne bibronii*, a feeble little toad, and one which is certainly not habitually a burrower. But *Limnodynastes dorsalis*, *Notaden bennettii*, *Chiroleptes platycephalus* and *Heleioporus pictus* are habitual burrowers. I have seen specimens of each of these species either actually burrow in earth, or go through the burrowing motions in a dish when I have had them under observation, in this case evidently a little surprised at the futility of their efforts; the hind legs in burrowing are moved outwards and downwards, either alternately or simultaneously, the shovel-shaped metatarsal tubercle evidently coming into play. All these species have the metatarsal tubercles of this character, the presence of which may I think be taken as *primâ facie* evidence of the burrowing propensity of their possessor. I have not seen *Limnodynastes ornatus* and *Heleioporus albopunctatus* alive, but from analogy these will also probably turn out to be burrowers.

L. dorsalis, judging from the abundance of croakers, must be one of our most abundant Sydney frogs; yet it is precisely one of the species of which under ordinary circumstances it is most difficult to procure specimens; a condition which is probably largely due to its nocturnal and burrowing habits. Once and only once I found a specimen under a stone; the only other way in which I have obtained specimens about Sydney is by going into the water after them when breeding, individuals at such times often allowing themselves to be caught without much difficulty. On the other hand, except in very dry weather, *L. tasmaniensis*

18

and *L. peronii* are generally obtainable without difficulty always in the cool months sheltering under logs and stones; and I know of no reason whatever for supposing that with us they are at all addicted to burrowing otherwise than exceptionally and as a last resource for æstivating purposes. Mr. Rose tells me as follows: "I have taken some notice lately of *L. salminii*, and I cannot find that it burrows like *Notaden* and *Chiroleptes*; it finds its way under logs and pieces of bark, lying very close but not appearing to have made any attempt at excavation; the same is true of the green frog (*Hyla cærulea*)."

(n) From Bearbong, Mundooran, on the Castlereagh (collected by Messrs. W. L. Gipps, and G. Macguire, and forwarded to me by Mr. F. A. A. Skuse).

Limnodynastes salminii	*Pseudophryne bibronii*
tasmaniensis	*Hyla cærulea*
Hyla rubella (one specimen, juv.)	

(o) From Trangie (collected by the Rev. J. Milne Curran, F.G.S.).

Notaden bennettii.

Eleven living specimens were exhibited at the Society's Meeting in December last.

(p) From Kiacatoo Station, on the Lachlan 20 miles below Condobolin (collected by Mr. T. G. Sloane).

Limnodynastes salminii	*Hyperolia marmorata*
tasmaniensis	*Crinia signifera*
Hyla peronii	

(q) From Emu Plains, Urana, about 18 miles from the Murrumbidgee at Narrandera (collected by Mr. T. G. Sloane).

Limnodynastes tasmaniensis	*Crinia signifera*
dorsalis	*Heleioporus pictus*
Hyperolia marmorata	*Hyla aurea*

Heleioporus pictus is not conspicuously coloured, resembling some specimens of *L. dorsalis*. The specimen sent me by Mr. Sloane when alive might be described as follows:—Pupil erect; iris silvery or golden veined with black, the anterior half with a dark horizontal mark forming with the contracted pupil an incomplete cross (cf. the complete cross in *Hyla peronii*, as already pointed out by Dr. Günther). Colour above pale olive with darker spots and patches, tolerably uniform but lighter on the flanks and limbs, and with a wash of bright yellow about the thighs and upper arms, a faint light vertebral line; beneath blotched on each side of the throat [no dark streak from the tip of snout to the eye in this specimen]. Fingers free, toes fully webbed, the webbing extending to the tips of the digits; [Mr. Boulenger says "toes two-thirds webbed;" in my Mudgee specimen the toes might be said to be about two-thirds webbed, but I know this specimen was put into strong spirit, and I fancy the webbing is somewhat shrunk.] The specimen is a breeding male, 40 mm. long from snout to vent; as in *Limnodynastes* there are two brownish rugosities on the inner side of the two inner digits of each hand; inner metatarsal tubercles black. Mr. Sloane found the specimen lying very close in a small cavity, with only his back visible, under a log close to the edge of a swamp.

We know so little of Victorian frogs [Professor McCoy has figured three more or less cosmopolitan species in Decade v. of the Prodromus of Victorian Zoology; and seven are recorded in Mr. Boulenger's Catalogue, or in the second of two supplementary lists] that no apology, I think, is needed for recording the two following collections.

Crinia signifera does not appear to have been previously recorded, though judging from the presence of twelve specimens in Mr. Froggatt's collection, it would seem to be as common in Victoria as elsewhere.

(a) From Benalla, Victoria (collected by Mr. T. G. Sloane).

Limnodynastes dorsalis *Crinia signifera*

Pseudophryne bibronii

(b) From Ballarat, Victoria (collected by Mr. W. W. Froggatt).

Limnodynastes tasmaniensis	*Crinia froggatti*, Fl.
Crinia signifera	*Pseudophryne bibronii*
Hyla ewingii	

This collection comprised sixty-two specimens, of which half were tree-frogs which I take to be the typical form of *Hyla ewingii*, that is to say, the form which is entirely devoid of large dark spots on the flanks, groin, or hinder sides of the thighs, a species recorded from Melbourne in the B. M. Catalogue. As the statements made by different authors as to the characters and distribution of *H. ewingii* disagree in several not unimportant points, I propose to offer some remarks on this subject on a future occasion. I may here remark that Mr. Froggatt brought me one Hyla alive because of its different appearance compared with the others. It is a beautiful little frog, light silvery bronze above, reminding one something of *H. dentata*, but with a bright green broad band down the back (and specks of green elsewhere), a not very well defined dark band commencing at about the level of the shoulder edging the green on each side, and another similar lateral band on the flanks soon disappearing. Whether this is *H. ewingii* or a variety of it, or whatever else it may be, I leave for further consideration.

[redacted]

DESCRIPTION OF A SUPPOSED NEW CYSTIGNATHOID FROG.

By J. J. Fletcher.

Crinia froggatti, sp n.

Vomerine teeth in two small groups behind the choanæ. Snout rounded, as long as orbital diameter; nostril equally distant from the eye and the tip of the snout; interorbital space broader than the upper eyelid; tympanum hidden. First finger hardly half as long as second; toes not fringed; subarticular tubercles indistinct; an inner small metatarsal tubercle; no tarsal fold. The tibio-tarsal articulation of the adpressed limb reaches nearly to the eye. Skin above with small scattered tubercles on the back; beneath smooth except for a triangular space on the lower and hinder sides of the thighs on each side of the median line which is very granular. Colour (a) of spirit specimens:—greyish above with blackish spots; a blackish band on each side from the tip of the snout through the eye to above the shoulder, frequently interrupted; a blackish transverse patch between the eyes sending off posteriorly a little on either side of the median line a ragged slightly divergent narrow longitudinal stripe at length becoming broken up into spots, sometimes the whole stripe much broken up; sides of body, and limbs a lighter grey spotted with blackish; lower surfaces dirty white the belly and limbs marbled or spotted with blackish, in the males the lips and throat also, the concealed surfaces of the body (axillæ, groin, front and hinder surface of thighs, inner surface of tibiæ, and upper surface of tarsus) with carmine patches and spots on a black background: (b) of living specimens, the whole dorsal surface is a reddish- or purplish-brown obscuring the dark patch, bands and spots, disappearing more or less after immersion in spirit; the sides of the body greyish-blue; the lower surface pale blue marbled with blackish; carmine spots and patches as above, not much affected by spirit.

Twelve specimens from snout to vent 18-26 mm.

Hab.—Buninyong, and Gong Gong, near Ballarat, Victoria; common under logs in valleys (W. W. Froggatt).

The specimens from the two localities differ to some extent in the amount of the dark tint present on the ventral surface, five from Buninyong being much more spotted or marbled.

This is a third species belonging to the section of the genus in which vomerine teeth are present, and it is in some respects intermediate in character between *C. georgiana*, D. & B., and *C. victoriana*, Blgr. It resembles the former in having carmine spots present, but differs in having the lower surface less granular, the tympanum quite hidden, the belly not immaculate, no tarsal fold, and but one metatarsal tubercle. On the other hand it is in many respects allied to *C. victoriana*, but differs from that species in not having the skin smooth above and below, as well as in pattern and colour.

DESCRIPTION OF A NEW CONE FROM MAURITIUS.

By John Brazier, C.M.Z.S., F.L.S.

Conus (Chelyconus) Worcesteri, n.sp.

(Plate xix., fig. 4.)

Shell turbinated, thick, ventricose round the upper part, smooth; spire acuminated, apex sharp, with minute spiral striæ below the suture; ivory white beneath a dirty yellowish epidermis, variegated with four purple or pinkish-brown bands flowing down here and there in flexuous streaks or blotches, columella slightly twisted; aperture white, lip thin.

Long 48, diam. maj. 25, aperture long 39 mm.

Hab.—Island of Mauritius (Mr. Robillard).

The upper half of this very pretty Cone shows four flexuous purple or pinkish-brown blotches, near the base there are three, with the aperture uppermost four are to be seen, two above and two below.

The type is in the collection of Mr. Worcester, of Frankston, Melbourne, Victoria.

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ON QUEENSLAND AND OTHER AUSTRALIAN LEPIDOPTERA, WITH DESCRIPTIONS OF NEW SPECIES.*

By Thomas P. Lucas, M.R.C.S.E., L.S.A., & L.R.C.P.Ed.

I am indebted to Mr. G. Barnard, whose collection I had the pleasure of inspecting during a most pleasant visit, and to Mr. R. Turner for much of the information contained in this paper. By their assistance I have been able to describe forty-two, which I believe to be new species, and record localities for other rare species.

Family SPHINGIDÆ.

Sphinx Eremophilæ, Lucas, "Queenslander," April, 1891.

As this species is so nearly allied to *S. marmorata,* and as the caterpillars were found feeding together by Mr. Barnard, I repeat the description here for comparison; the descriptions of both were first sent to this Society in July, 1890.

♂♀. 58-70 mm. Palpi grey. Antennæ grey, reddish beneath. Head dark fuscous. Thorax fuscous, shoulders and epaulettes grey. Abdomen cinereous grey, with a dark brown line down the centre of dorsum, and deep dark brown angulated lateral lines; base of segments rich fulvous brown, deep brown angular patches extend from sides to dorsum, between base of each centre segment and next segment. Forewings triangular, elongate, costa nearly straight, rounded toward apex, hindmargin obliquely rounded; fulvous grey, with darker shadings and with darker fulvous broken bands, not always clearly defined; 1st band in central

* The following paper comprises the substance of two communications read before the Society in May and August, 1890, and now published by order of the Council.—Ed.

third of wing at $\frac{1}{8}$ is shaded off toward base, and becomes diffused toward costa; 2nd and 3rd bands rise from one stalk at $\frac{1}{8}$ to $\frac{1}{4}$ inner margin, which divides into two in a curve to $\frac{1}{3}$ and $\frac{2}{3}$ costa, and in some cases splits into three or four bands on costa, an interrupted ill-defined band rises at $\frac{2}{3}$ inner margin, and unites with a darker band from $\frac{1}{4}$ inner margin, at first outwardly, then inwardly, to $\frac{3}{4}$ costa; a lighter brown space separates this from the next band, which runs nearly parallel from $\frac{4}{5}$ inner margin to $\frac{5}{6}$ costa. cilia grey, brown at base and on veins. Hindwings grey brown with shades of dark fulvous, darker toward hind margin.

Caterpillar slender, attenuated anteriorly: blue grey, speckled with grey, stomata red, dorsal and lateral bands vermilion red, in interrupted patches; tail black.

Found in large numbers by Mr. G Barnard at the Dawson River, feeding on the *Eremophila Mitchelli*, locally known as sandalwood.

SPHINX MARMORATA, sp.nov.

♀ 60 mm. Head grey, collar black. Palpi blackish grey. Antennæ brown. Thorax hairy, mottled grey and white. Abdomen ochreous, dorsal and lateral lines black, lateral lines connected by dark black lines with base of each segment, and so forming a square figure in each segment, on either side of dorsum, or an oblong of ground colour, which gives a singular marbled appearance to the insect; anal segment irrorated grey and white, underside light grey. Forewings elongate, triangular, costa nearly straight, apex rounded, hindmargin obliquely rounded; grey, irrorated with white near base, and with fuscous near costa: two oblique fuscous diffused lines from $\frac{1}{4}$ inner margin to apex of costa, and from $\frac{3}{4}$ inner margin to apex of hindmargin. veins beyond first line brown, four or five black arrow-shaped lines between veins; cilia white with smoky-grey spots on veins. Hindwings light brown, light ochreous grey at base: veins smoky-grey.

Caterpillar attenuated anteriorly, glaucous-green, dorsal and lateral lines white, latter with tooth-like projections into each

[redacted]

segment; tail annulated green and brown. Found in company with preceding by Mr. Barnard on *Eremophila Mitchelli*. Five caterpillars, only one of which matured to imago. Allied to *S. Eremophilæ*, but easily distinguishable by marbled appearance of abdomen, and by darker colour and fuscous bands on wings.

Duaringa, Queensland.

Family ARCTIADÆ.

CALLIGENIA PILCHERI, sp.nov.

♂♀. 17-19 mm. Head and palpi vermilion, collar marone-red. Antennæ grey, vermilion at the base. Legs vermilion, grey on under side. Thorax deep marone-red, with anterior border behind collar ochreous-yellow, base of epaulettes yellow. Abdomen vermilion. Forewings elongate, strongly dilated, costa moderately arched, apex obtuse, hindmargin obliquely rounded; deep marone-red, with ochreous-yellow spots; an irregular square spot at $\frac{1}{3}$ costa extends to $\frac{2}{3}$ towards inner margin, costal half vermilion: between this and inner margin is a small dot posteriorly; adjacent to it, from $\frac{2}{5}$ of inner margin, an irregular row of six spots runs to just before apex of hind margin, but sixth spot does not touch hindmargin; the inner margin of first spot is vermilion; a conspicuous spot at $\frac{3}{5}$ costa; two spots on hindmargin in a line with hindmarginal sub-apical spot: cilia marone-red tipped with vermilion. Hindwings with basal half vermilion, posterior half rich marone-red; cilia marone tipped with pink.

Rockhampton; two specimens, caught by Mr. Pilcher.

CALLIGENIA MELITAULA, Meyr.; Townsville (Mrs. Barnard).

ASURA (?) BISECTA, sp.nov.

♂. 18 mm. Head velvety-black, collar ochreous-yellow. Palpi ochreous-yellow. Antennæ bipectinated, black. Thorax black with tip of epaulettes ochreous-yellow. Abdomen black, anal tuft ochreous-yellow. Forewings elongate, triangular, gently dilated, costa straight, hindmargin obliquely rounded; ochreous-yellow;

black at base and with a black band bisecting the wing from base to hindmarginal band opposite ⅓ hindmargin, and with a dentate projection toward inner margin from middle; a broad black hindmarginal band: cilia grey. Hindwings ochreous yellow, with broad black hindmarginal band, narrowed to a band of black hairs along inner margin, but more spread out at base; cilia grey.

I think this species will have to be made into another genus, but place it here provisionally. I caught one specimen while out with Mr. Barnard, who had not seen it before.

Duaringa, Queensland; in May.

Family HYPSIDÆ.

Nyctemera secundiana, sp. nov.

This species of *Nyctemera* was included in Meyrick's description of *N. tertiana*. I got specimens of both species and of *N. crescens* at Port Douglas, which I submitted to him. I believed with him at the time that both were varieties of one species, which he named new as *N. tertiana*. I now propose to separate the type as above from the type *tertiana*.

In *secundiana* the spot between the eyes and the two spots on the collar are prominent and deep black; in *tertiana* they are faintly represented or altogether absent. In *secundiana* the epaulettes are longer, better developed, and the black stripes more prominently shown. In *secundiana* the white blotch in the hind wing is more a yellow-white and occupies less than one-third, extending from just before centre of wing with ½ depth of wing hindmarginal border; in *N. tertiana* the whole of the hindwing is more a snow-white, with an angular black border along hindmargin and costa.

N. secundiana is common at Brisbane, but though I have caught hundreds of *N. amica* and *N. secundiana*, I never caught the form with the hindwing so broadly white, and to which I propose to restrict Meyrick's name *tertiana*, in Brisbane. Mr. Barnard takes *N. secundiana* but never *tertiana* at Rockhampton.

[redacted]

Five species of *Nyctemera* run very closely. It will be interesting to obtain the history of caterpillars and food plants of all, to ascertain if they are non-interbreeding species, or if they are but climatic varieties. I may sum up the five as follows :—

N. annulata—very black, two small bars of dots in forewings, and one small dot in hindwings, white. New Zealand.

N. amica—broad bar of white divided by black veins in forewings, small round white spot in hindwings. Melbourne to Brisbane.

N. secundiana—broader bar of yellowish-white in forewing, much larger blotch in hindwing. Brisbane to Cooktown.

N. tertiana—forewing as *secundiana*, hindwing $\frac{2}{3}$ white with narrow black border. Mackay to Cooktown.

N. crescens—narrower white band in forewing; veins not black, in male a club-shaped white mark in middle third of wing, from base outward ; hindwings as in *tertiana*. Mackay to Cooktown.

Family SYNTOMIDIDÆ.

HYDRUSA RECEDENS, sp. nov.

♂♀. 15-16 mm. Head orange, with a black mark between antennæ. Antennæ black. Thorax black, orange anteriorly, and with orange epaulettes. Abdomen iridescent, orange, with base of segments narrowly velvet black, apical segment orange, with broader black band at base, and fringe tipped with light smoky-grey Forewings black ; spots thinly scaled, light orange, and leaving the black ground colour only as bands or borders in three series ; first, a clavate spot nearly touching inner margin at $\frac{1}{4}$ to half-way across wing, and projecting toward base ; second series in the transverse middle third, nearly touching inner margin, but with a broad costal margin, divided by two lines into three, a subquadrate costal spot, a small central triangular spot, a broader triangular spot near inner margin ; third series in posterior third of wing, divided into three bar lines parallel to costa, costal one longer than the other two. Hindwings black; spots light orange;

first spot thickly scaled, occupies basal third of wing; second spot in posterior third of wing almost touching costa.

Duaringa (Mr. Barnard).

Group BOMBYCINA, Family HEPIALIDÆ.

PORINA KERSHAWI, sp.nov.

♂. 70-80, ♀. 108 mm. Head and thorax ochreous-fuscous. Antennæ ochreous-fulvous. Abdomen ochreous-fulvous. Forewings elongate, costa slightly sinuous, hindmargin obliquely rounded in continuation with inner margin, light ochreous, with patches of fuscous and chains of creamy white spots and dots edged with fuscous; costa dark fuscous in basal half, lighter posteriorly, a creamy-white longitudinal streak in disc from base to near hindmargin, along inner margin of vein 7, six rows of creamy-white spots, bordered with fuscous; 1st as a single dot on costal border, and a dot and line on inner border of discal streak at $\frac{1}{4}$, 2nd, dots and short bars from $\frac{1}{3}$ costa to $\frac{1}{4}$ inner margin; 3rd from costa at $\frac{2}{3}$, 4th from costa immediately beyond, and 5th immediately beyond again; all as necklaces of bead-like dots converge to a point in 2nd line near inner margin, 6th line from just before apex of costa to junction of inner and hindmargin is doubled at apex and in middle third, a sub-marginal row of dots of light ground colour bordered by a line of fuscous; veins fuscous; cilia fuscous. Hindwings ochreous-fulvous, veins browner fulvous; cilia ochreous-fulvous.

The ♀ is larger, more of a drab tint, and less fulvous, but the markings are similar to those in ♂. In some specimens the white bead dots are absent, in others they are only defined by the fuscous line rings.

Eltham and neighbourhood of Melbourne.

I have great pleasure in naming this species after the late Mr. David Kershaw, a young entomologist in Melbourne, from whom I received it, and who was cut off by a too early death from a zealous and useful career.

HECTOMANES FUSCA, sp.nov.

♂. 18-20 mm. Head, antennæ, thorax and abdomen fuscous, or fuscous-red. Forewings elongate, costa nearly straight, apex rounded, hindmargin rounded in continuation with inner margin, chocolate-brown or deep fuscous; costa darker fuscous, with a few dark spots; discal spot dark fuscous, almost black: cilia ochreous-fuscous. Hindwings smoky-fuscous; cilia as forewings.

♀. 26-28 mm. Head, thorax and abdomen light drab or ochreous-brown. Forewings, hind border more obliquely rounded than in ♂, grey-fuscous or dusty-drab—discal spot indistinct—a number of brownish dots, only seen with glass, give wing a dusted appearance. Hindwings coloured as forewings but without dots.

Moe, Gippsland, 1000 feet. Much smaller than *H. simulans*, Walk., from which it differs in colour and in entire absence of any white mark in disc; the forewings are broader than in that species.

HECTOMANES CROCEA, sp.nov.

♂. 26-28 mm. Head and thorax mahogany-red. Antennæ fuscous. Abdomen ochreous. Forewings with costa gently rounded, hindmargin rounded, continuous with inner margin, mahogany-red or saffron-red; small black discal dot: cilia mahogany-red. Hindwings ochreous-red or saffron-brown; cilia as forewings.

♀. 36-38 mm. Head and thorax a vermilion or brick-red. Abdomen ochreous. Forewings more a light vermilion-red, hind margin obliquely rounded to inner margin, discal spot smoke colour; in some specimens a number of smoky-grey dots scattered over wing and extending along hind and half way along inner margin: cilia vermilion-red. Hindwings ochreous; cilia vermilion red.

Brisbane.

The mahogany-red of the ♂ and vermilion-red of the ♀ distinguish this as perhaps the most showy of the genus.

Hepialus Daphnandræ, sp.nov.

♀. 80 mm. Length of body 48 mm. Head green, eyes red. Thorax green. Abdomen anterior third red, posterior $\frac{2}{3}$ green. Forewings broadly dilate, triangular, costa rounded towards apex, hind margin nearly straight; green with purple-brown spots along the costa, most developed in middle third, numerous indistinct transverse bluish short lines or dots and forming a continuous dark line broken between veins, from $\frac{3}{4}$ costa to $\frac{1}{2}$ inner margin; veins deeper green, small hindmarginal purple-brown spots between veins; cilia purplish-green. Hindwings with basal half and inner half vermilion-red, remainder of wing yellow-green; cilia olive green.

From pupa on *Daphnandra micrantha*, allied to *H. Scotti*, Scott.

Brisbane.

This specimen is, I believe, small; other larvæ were promising to be much larger.

Hepialus hilaris, sp.nov.

♂. 58-62 mm., body 34 mm. Head green. Antennæ red. Thorax ochreous-green, with dark green lines on dorsum and sides. Abdomen ochreous-green, with a long orange tuft on either side anteriorly. Forewings elongate sub-triangular, costa slightly sinuous, apex sub-falcate, hindmargin rounded in continuance with inner margin, light pea green, crossed through entire length by bead-like ring and banded lines of milky blue and light glaucous green, enclosing ground-colour spots and lines, giving a very pretty mottled appearance, costa deep sea-green; a row of creamy-silvered spots from opposite $\frac{3}{4}$ costa, but not touching costa, to vein 2 opposite middle of inner margin; a faint row of bead-like milky-blue rings from $\frac{1}{4}$ costa to $\frac{1}{4}$ inner margin, a lunulated dentate like colour line immediately beyond and another sub-marginal with lunules concave and opposite to these; cilia olive-green. Hindwings milky-blue; cilia olive-green.

♀. 75-90 mm., body 45 mm. Head and thorax green. Antennæ red. Abdomen, anterior half red, posterior half green. Forewings pea-green, hindmargin very obliquely rounded; costa dotted with short purplish-red bars and dots, and hind and inner margins bordered with purplish-red line, interrupted near apex by veins; pea-green, and covered with narrow diffused rings of sea-green between veins, which, in contrast to the enclosed ground-green, gives the appearance of a tessellated pavement. This is more distinct and regular in posterior half, and is more irregular and faintly marked towards base. Two small discal spots of white, surrounded by purple-brown border lines, obliquely to each other at opposite $\frac{2}{3}$ costa: cilia ochreous-purple. Hindwings salmon-pink, apex of wing and hindmargin light olive-green; cilia olive-brown.

Gippsland; in stems of wattle and other trees; allied to *H. Scotti*, Scott.

Family LIPARIDÆ.

TEARA TOGATA, sp.nov.

♂. 40 mm. Head ochreous-brown. Palpi ochreous-brown, tipped with lighter brown. Antennæ ochreous, pectinations fuscous. Thorax rich ochreous-brown. Abdomen black, tipped with a fringe of ochreous-brown. Forewings with costa rounded from $\frac{2}{3}$, hindmargin obliquely rounded, inner margin from base to $\frac{2}{5}$, a large discal spot, and hindmarginal fourth of wing ochreous-brown, remainder of wing shining purple-grey: cilia light ochreous-brown. Hindwings light ochreous-brown, darker toward base and inner margin; cilia as forewings.

Allied to *T. Edwardsi*, Newm., and to *T. albidescens*, but readily distinguished by the purple-grey which shades forewings as a toga cloak.

Brisbane; two specimens.

TEARA FIMBRIATA, sp.nov.

♂. 24 mm. Head light creamy-drab. Palpi blackish-brown, tipped with creamy-white. Antennæ fuscous. Thorax fuscous.

Abdomen light creamy-drab. Forewings, costa rounded, hindmargin rounded; purple-grey, shining and darker posteriorly, bordered by an indented hindmarginal yellow band or fringe: cilia yellow. Hindwings and cilia creamy-drab.

Brisbane; one specimen; May, 1890

Darala expansa, sp.nov.

♀. 118 mm. Head and antennæ creamy ochreous, collar black. Palpi brown. Thorax drab, white, downy, resembling wool. Abdomen light fawn colour with a ridge of light-coloured long hairs round base of each segment. Forewings triangular, broadly dilate; costa rounded, apex very acute, hindmargin rounded; fuscous with irrorations of red or fuscous, and light fuscous and creamy-red scales, basal fifth drab-white or wool-colour, bordered by a smoke-colour line from ¼ costa to ¼ inner margin; a conspicuous rich black line from ¾ costa to ¾ inner margin, bordered posteriorly by a wool-colour suffused line; the ground-colour between 1st and 2nd lines is a darker fuscous, relieved with smoky-grey and brown suffusions; discal spot large, just before centre of wing at ⅓ from costa, creamy ochreous, bordered with black, a broad suffused band of reddish cream-colour beyond 2nd line, bordered posteriorly by wavy crenulate undefined line of diffused brown, which suffusion extends to hindmargin; hind marginal line and cilia smoky-brown. Hindwings ochreous-brown for basal fourth; creamy-ochreous to nearly ½; a broad brown-ochreous band beyond ½, bordered anteriorly with brown line and posteriorly with deep rich black line and a black suffusion; a creamy-red band, suffused with smoky-brown scales, and bordered posteriorly by a wavy crenulate black-brown line, and by a dark brown suffusion with smoke-colour scales to hindmargin, black patch on inner margin at ¼; cilia smoky-brown.

Dawson River; one specimen (Mr. G. Barnard).

Darala magnifica, sp.nov.

♂. 70 mm, ♀. 100 mm ♂. Head black, face grey. Palpi black. Antennæ white, pectinations black. Thorax brown,

covered with orange and white hairs, and posteriorly by a tuft of orange-tipped hairs on either side and with two small tufts of black and orange-tipped hairs on dorsum. Abdomen ferruginous-orange, and with extreme tip and underside white; legs black, femora with yellow spot on tip. Forewings, costa rounded toward apex, hindmargin rounded, grey with black markings and snow-white irrorations and diffusions; five transverse black-brown fasciæ, more or less interrupted; 1st from $\frac{1}{4}$ costa to near inner margin at $\frac{1}{4}$; 2nd immediately beyond; 3rd at $\frac{1}{2}$ costa, toward hindmargin, then deflexed and nearly straight across middle of wing to $\frac{1}{2}$ inner margin, this the broadest and richest coloured; 4th immediately beyond; 5th beyond this again, but interrupted and indistinct toward costa and toward inner margin; there is an irregular dentate crenulate interrupted hindmarginal fascia from just before apex of costa, to just before anal angle of inner margin; there is a black patch on costa at $\frac{1}{8}$, which is diffused into narrow lines, which disappear on wing; a rich black-brown band starts from 1st transverse fascia at $\frac{1}{4}$ from costa, and runs nearly parallel with costa to $\frac{1}{3}$ hindmargin; it contains a small-snow-white discal spot as it crosses 2nd fascia, and a large white discoidal spot as it crosses 3rd fascia; a similar band starts from 1st transverse fascia at $\frac{1}{3}$ from inner margin and runs parallel with inner margin to $\frac{4}{5}$ hindmargin; between this and the sub-costal band 3 parallel grey-brown bands occupy the space between the veins: cilia brown, white opposite the veins. Hindwings brown, with grey and smoky-white along outer half of veins, and along anal third of inner margin; some orange diffused hairs near inner margin; cilia as in forewings. Underside grey, with ferruginous in basal half of forewings, and towards costa, with rich black-brown band from $\frac{1}{2}$ costa of forewings to $\frac{1}{2}$ inner margin hindwings, where it is lost in black suffusion. Discal and discoidal spots are large on forewings, discal spot is small and white on band in hindwings; light-grey bands stretch across $\frac{3}{4}$ to $\frac{4}{5}$ of both wings.

♀ is larger, brown on face, the white hairs on head and thorax completely hide the ground-colour; the abdomen is ferruginous rather than orange; the forewings are irrorated and suffused with

white in basal third, and through posterior $\frac{1}{5}$; the middle third of hindwings is suffused with grey and white as a broad dentate fascia.

Dawson River, Queensland.

This beautiful species was brought to Mr. Barnard, Dawson River, by the blacks, who found caterpillars and chrysalises under bark of trees. I obtained a series of chrysalises of an allied species some years ago under the bark of a large gum tree near Deniliquin, N.S. Wales. Butler named the moth *D. stygiana*, and remarked that it was the finest species yet discovered. The species here described is half as large again as *D. stygiana*.

Darala asciscens, sp.nov.

♂♀. 96-110 mm. Head brown tinted with grey. Palpi black. Antennæ black. Thorax black. Abdomen black, with brown diffused laterally and posteriorly, grey on under surface. Forewings, costa rounded near apex, hindmargin nearly straight, smoky-grey with black markings and free irrorations of ashy-grey; an irregular wavy tortuous narrow fascia, brown-black, from $\frac{1}{5}$ costa to $\frac{1}{4}$ inner margin; the ground colour from this to base of wing is lighter drab-brown posteriorly, and as far as a rich black band extending from $\frac{1}{3}$ costa to $\frac{2}{3}$ inner margin the ground-colour is a darker grey, and is crossed irregularly near its anterior border by irregular interrupted patches of dark fascia; on anterior border of the black band at $\frac{1}{4}$ from costa is a prominent round white discal spot, bordered with black; from $\frac{4}{5}$ costa to $\frac{3}{4}$ inner border a narrow rich black sinuous line is bordered posteriorly with a more or less defined white line, another waved denticulate blackish line from just before apex of costa to just before anal angle of inner margin is bordered anteriorly by a conspicuous white line: cilia brown-grey. Hindwings drab, lighter toward base, and crossed by darker band $\frac{2}{5}$ costa to $\frac{1}{3}$ inner margin, and by 3 wavy dentate lines at $\frac{3}{4}$, the anterior smoky-grey, the middle lighter grey, and the posterior one white-grey; cilia as forewings. Underside light-grey with a brown band across both wings, from

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$\frac{1}{2}$ costa forewing to $\frac{1}{3}$ inner margin of hindwing; a 2nd line, more sinuous, from $\frac{3}{4}$ costa of forewing parallel with hindmargin of both wings to $\frac{3}{4}$ inner margin hindwing. On front wing a brown dot is bordered by black and a conspicuous white spot is bordered by black; on hindwing there are two brown spots.

The ♀ is slightly larger than ♂ and somewhat lighter.

Dawson River (Mr. Barnard). Allied to *D. magnifica.* The cocoon is different, being as Mr. Barnard says a hanging cocoon, whereas that of *D. magnifica* is spun on to inner side of bark through its whole length.

DARALA LINEARIS, sp.nov.

♀. 60 mm. Head, palpi, antennæ, thorax, and abdomen light cinnamon-brown. Forewings, costa slightly wavy, apex slightly falcate; hindmargin rounded, shining cinnamon-brown sparingly dotted with scattered black points, and seven or eight straight transverse smoky-brown lines and fasciæ; two wavy lines at $\frac{1}{4}$ are more or less indistinct, and more or less run into each other; a sinuous line at $\frac{1}{3}$ is well marked and contains an indistinct small black discal spot at $\frac{1}{3}$ from costa; another line at $\frac{1}{2}$ and one immediately beyond are distinct, but faint; a very deep smoke-coloured band at $\frac{3}{4}$ costa to $\frac{4}{5}$ inner margin is bordered anteriorly by narrow edging of orange-brown, and suffused posteriorly into a deeper shade of ground colour, where it forms an indistinct bounding line; a submarginal line is faintly marked; an indistinct black discoidal spot just before band at one-third from costa: cilia cinnamon-brown, darker at base. Hindwings coloured as forewings, but not shiny; a smoky line at $\frac{1}{4}$ indistinct, a well-marked smoke-colour band at $\frac{1}{2}$; a broad smoke-colour fascia or suffusion from $\frac{3}{5}$ to near apex of costa, narrowing to one half its expansion toward inner border near anal angle; a series of minute sub-marginal black dots on veins; cilia as forewings.

Mackay; one specimen (Mr. R. Turner.)

DARALA SUCCINEA, sp nov.

♂♀. 65 90 mm Head, palpi, antennæ, thorax, and abdomen amber coloured. Legs black brown Forewings, costa nearly straight, hindmargin obliquely rounded, amber coloured, some specimens have a reddish tint, with smoky-black markings, an irregular diffused line, lunulated in middle 3rd toward hind margin from ¼ costa to ¼ inner margin; a small smoke-colour discal spot beyond the middle of wing ⅓ from costa, a straight red line curved inwards at costa from near ¾ costa to ½ inner margin, immediately beyond and parallel is a crenulate smoke-colour line deepened into a spot on the veins: cilia ochreous brown Hindwings as forewings, first smoky line and red line less distinct, second smoky colour line very defined, cilia as forewings.

The Wimmera, Victoria, taken by Mr. Hill.

DARALA SCORTEA, sp nov.

♂. 62, ♀. 82 mm. Head, antennæ, thorax, and abdomen in ♂ ochreous brown or the colour of chamois leather, in ♀ lighter chamois tint. Palpi in ♂ black-brown, in ♀ light chamois tint Legs in ♂ black brown, in ♀ colour of body, head of femur in both with a snow white spot Forewings, costa rounded toward apex, hindmargin rounded, in ♂ colour and appearance of chamois leather, in ♀ of a lighter more ochreous shade, an indistinct diffused smoky line at ¼ and another at ¼ costa, interrupted toward each other at ⅓ from costa, whence they proceed as one line wavy and interrupted to ¼ inner margin, and thence to ½ inner margin of hindwings: a pale fuscous discal spot in posterior line and another more distinct beyond middle of wing at ¼ from costa; a crenulate smoke-colour line pointed on veins, and bordered posteriorly with red from ¾ costa to ½ inner margin: immediately beyond this a crenulate smoky-colour line, darker at veins, and diverges further apart toward inner margin: cilia reddish brown. Hindwings as forewings, with the two median

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lines from $\frac{3}{4}$ costa to close to first line at $\frac{1}{2}$ inner margin ; cilia as forewings.

Balranald, N.S. Wales ; two specimens.

Allied to *D. succinea*, but of a different texture, having a leathery appearance, and with the transverse lines differently coloured and arranged.

DARALA RUBRISCRIPTA, sp.nov.

♂. 53 mm. Head, antennæ, thorax, abdomen brownish-yellow. Palpi light fuscous tipped with cream-white. Forewings, costa gently rounded, hindmargin rounded, brownish-yellow with shade of ochreous: four lines or fasciæ deep gamboge-brown, 1st from near base of costa for a short distance along costa, thence as an indistinct crenulate circular line to $\frac{1}{4}$ inner margin, a broad gamboge-brown band stretches from this first line along costa to beyond $\frac{1}{3}$, thence as a dentate circular line to near centre of wing, where it winds again toward base and runs to inner margin at $\frac{1}{3}$, costal half dark, inner half paler: a deep gamboge-brown line from a blotch at $\frac{2}{3}$ costa to $\frac{2}{3}$ inner margin : immediately beyond this and parallel is a light yellow-brown line, and beyond it again, a row of indistinct brown dots on the veins: cilia ochreous-brown. Hindwings coloured as forewings with three bands, 1st at $\frac{1}{4}$ indistinct, 2nd at $\frac{1}{2}$ a plain line, 3rd at $\frac{2}{3}$ crenate.

Mackay (Mr. R. Turner.)

DARALA ROSEA, sp.nov.

♂. 32 mm. Head, palpi, antennæ, thorax, and abdomen orange, thorax more tinted with rose-red, abdomen less so, tip cream-colour. Forewings, costa nearly straight, hindmargin rounded, orange-drab, with rose-red on the veins and minute black dots between veins: a dark line from near base, crossed by indistinct transverse smoky line at $\frac{1}{6}$, and extending to $\frac{1}{2}$ centre of wing, where it touches a smoky-colour fascia extending from $\frac{3}{4}$ costa to $\frac{1}{2}$ inner margin: a sub-marginal fascia smoky-black mixed with rose-red on veins: cilia cream-colour. Hindwings

orange, tinted with rose-red; cilia cream-colour The ♀ is slightly larger, but similar.

I had a pair from Cooktown, but have lost the ♀. The rose-red veins render this species very distinct and beautiful.

Family SATURNIDÆ.

ANTHERÆA LORANTHI, sp.nov.

♂♀. 100-145 mm. Head, antennæ, thorax, and abdomen deep chocolate-brown. Collar deep smoky brown. Forewings with costa rounded, apex rounded, hindmargin wavy, oblique, deep chocolate-brown. Costa at base deep smoky-brown, in a line continuous with collar, and gradually thinning out to $\frac{2}{3}$, discal ring in some specimens rather angulated, ovoid to rhomboid, consisting of a fine line externally black on outer border, brown on inner border, and lined on inner border with lighter brown, and an inner dark brown ring lining outer border, which stretches for $\frac{2}{3}$ towards inner border and contains a lighter shade within; a broad band from $\frac{2}{3}$ costa to $\frac{1}{3}$ inner margin, deep smoke-colour with lighter smoky grey on either border cilia chocolate-brown. Hindwings coloured as forewings; discal rings more rounded, darker externally with lining of smoky-grey; a narrow band from $\frac{2}{3}$ of inner margin, in some few specimens smoky grey, in most simply a darker ground-colour and almost obsolete, curving parallel to hind margin toward $\frac{2}{3}$ costal margin, but in all cases losing its smoky-colour and in most becoming obsolete before reaching costa. Undersurface plain brown with discal rings as upper surface, and with veins prominent and brown.

Brisbane to Duaringa.

About a dozen years ago or more Mr. Illidge climbed a eucalypt tree, 40 yards high, on the bank of the Brisbane river on what is now known as the North Quay. He succeeded in obtaining a congregation of some 40 or 50 hard woody cocoons on a large plant of mistletoe, and was fortunate to breed out a good harvest of this moth. One specimen, Mr. Edwards informs me, found its

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way to the British Museum, and is there labelled *A. Eucalypti.* Mr. Illidge distributed his find to the Museum and to others. Mr. Barnard and his sons at Duaringa also found this fine species feeding on *Loranthus.* It is thus necessarily a gregarious species, and in its habits, character, and in fact in all points differs from *A. Eucalypti.* It comes near to *A. Banksii,* Leach, or *A. Helenæ,* Scott.

A. intermedia, Luc., may be a climatic variety of *A. Helenæ,* but it is not nearly so large nor leathery as the Newcastle type.

Group GEOMETRINA, Family GEOMETRIDÆ.

IODIS IMPLICATA, sp.nov.

♀. 28 mm. Head blue, fillet white. Palpi grey. Antennæ red above, ochreous beneath. Thorax blue-green. Abdomen blue-green, laterally and posteriorly ochreous-green. Forewings, costa straight, rounded before apex, hindmargin gently rounded, dull blue-green, freely covered with faintly marked short transverse ochreous strigulæ; costa narrowly ochreous; two pale ochreous-green lines, first line from $\frac{1}{6}$ costa, angled outward near costa to $\frac{1}{4}$ inner margin; second line from $\frac{3}{5}$ costa to $\frac{3}{5}$ inner margin: cilia ochreous. Hindwings as forewings in colour, strigulæ, &c.; first line from $\frac{1}{4}$ costa as far as vein 4 opposite $\frac{1}{3}$ inner margin; second line from $\frac{2}{3}$ costa bent round on vein 3, parallel to hind border to $\frac{2}{3}$ inner margin; cilia ochreous, on inner margin blue-grey.

Rockhampton; one specimen (Mr. Barnard). Allied to *I. ocyptera,* Meyr.

IODIS BARNARDÆ, sp.nov.

♂♀. 11-15 mm. Head rufous-brown, fillet white. Palpi brown. Antennæ white, pectinations carmine. Thorax yellow in front, becoming greener, light green. Abdomen light green, ochreous beneath. Legs light brown, ochreous on under side. Forewings, costa nearly straight, hindmargin rounded, light green: an indistinct milky rounded line from $\frac{1}{3}$ costa to $\frac{1}{3}$ inner margin: beyond

this at $\frac{1}{4}$ from costa a minute brown discal spot: a second milky line from $\frac{2}{3}$ costa to $\frac{2}{3}$ inner margin: a dentate hindmarginal line deep purple-red: cilia grey, base purple-red. Hindwings as forewings, with first line wanting, discal spot very minute, second line $\frac{2}{3}$ costa to $\frac{2}{3}$ inner margin; hindmarginal line a series of purple-red spots; cilia as forewings.

I took a specimen at Duaringa station, beaten out of a wattle bush in May. I found Mr. Barnard had a pair in his collection unnamed. I am pleased to dedicate the species to Mrs. Barnard, who is so greatly aiding entomological science by her illustrations of life-history, larvæ, imago and food plant. I have this season obtained one specimen at Brisbane.

Iodis crenulata, sp.nov.

♂. 20 mm. Face red-brown, fillet and crown wool-colour white, posteriorly reddish-tinged. Palpi red, terminal joint ochreous-white. Antennæ white, pectinations ochreous-grey. Thorax olive-green, shoulders red-brown. Abdomen olive-green, underside whiter. Forewings with costa nearly straight, hindmargin obliquely rounded, olive-green; costa with a broad ochreous line attenuated to apex and bounded posteriorly by an orange-ochreous line, broadened at the base; five crenulate ochreous-green lines and parallel with hindmargin are arranged in two groups; the first line is from $\frac{1}{5}$ costa to $\frac{1}{5}$ inner margin, the second line is immediately beyond, just beyond which again and almost touching at $\frac{1}{3}$ from costa is an indistinct smoke-colour discal spot; the second group begins with the 3rd line, which runs from $\frac{4}{5}$ costa to $\frac{2}{3}$ inner margin, immediately beyond which is the 4th line, and again the 5th line, contiguous but not touching: cilia ochreous tinged with red. Hindwings with colour, the two groups of lines and cilia as in forewings.

Near Brisbane; one specimen; taken by Dr. T. Bancroft. This species is not nearly related to any with which I am acquainted.

[redacted]

IODIS MULTITINCTA, sp.nov.

♂. 22 mm. Head blue-green, fillet darker green. Palpi bluish-grey. Antennæ greenish-grey. Thorax blue-green. Abdomen blue-green, lighter posteriorly, and milky-colour underneath. Forewings with costa arched, hindmargin gently arched, blue-green, iridescent, with olive-green, blue-grey, milky-grey and slaty-grey scales all mixed in a kind of chameleon suffusion. A minute black discal spot, in some specimens indistinct, a suffused olive-green band from $\frac{1}{5}$ costa to $\frac{1}{3}$ inner margin, often indistinct, a suffused olive-green bar from $\frac{3}{4}$ costa to $\frac{2}{3}$ inner margin: cilia greenish-white, greener at base. Hindwings as forewings, angulated at vein 4, discal spot black, indistinct in most specimens, olive-green suffused band as in forewings, from $\frac{3}{4}$ costa to $\frac{2}{3}$ inner margin, arched and bent opposite hindmarginal bend at vein 4; cilia greenish-white, greener at base.

Brisbane; rare.

This species is a most delicate one, and is difficult to obtain at all perfect. I have not yet seen the ♀. It comes near *I. centrophylla*, Meyr.

IODIS MILITARIS, sp.nov.

♂♀. 26 mm. Head brownish-red, fillet light green. Palpi brownish-red. Antennæ ochreous-brown. Thorax light green. Abdomen light green, whiter at sides, with golden dots bordered with copper-red on dorsum, finer in ♂ than ♀. Forewings with costa gently arched, hindmargin obliquely rounded, very light pea-green; costa edged with a fine ochreous line with six or seven very fine deep chocolate or blackish dots; a small deep chocolate or blackish discal dot at $\frac{2}{5}$ one-third from costa, a second dot at $\frac{4}{5}$ one-fourth from costa: cilia creamy-ochreous with fine chocolate or blackish dots on veins. Hindwings as forewings, hindmargin rounded on vein 4, discal spot as in forewings at $\frac{2}{5}$, $\frac{1}{3}$ from costa; cilia creamy-ochreous with chocolate or blackish dots on veins, more conspicuous than in forewings.

Brisbane; two specimens. Allied to *I. leucomerata*, Walk.

Agathia iodioides, sp.nov.

♀. 22 mm. Head black, face blackish-red. Palpi ochreous. Antennæ ochreous, becoming red toward base. Thorax pea-green, posteriorly on dorsum a red-white line bordered by deep red. Abdomen grey with red blotch and central line anteriorly, and a narrow red line thinning out posteriorly. Forewings rounded, costa rounded, apex rounded, hindmargin rounded, pea-green; costa bordered by black-red line freely irrorated with black scales, broader from $\frac{3}{5}$ to $\frac{3}{4}$, at each of which points is a black spot; the hindmarginal band is black red and contains six ochreous dots, and is broadened into a projecting angle at $\frac{1}{2}$ and diffused into an oblong blotch at anal angle: cilia reddish-white. Hindwings pea-green with hindmarginal band and cilia as in forewings; hindmargin rounded at vein, the band projecting inward in an angle.

Dawson River; one specimen (Mr. Barnard).

This species at first appearance reminds one of a half-sized ordinary *Agathia*, with the bands in the forewings wanting, excepting in the margins.

Agathia distributa, sp.nov.

♂♀. 28-32 mm. Head pea green, face red, collar light ochreous-red, with red dots anteriorly in centre, on either side and posteriorly. Palpi ochreous-grey. Antennæ red, ochreous beneath. Thorax pea green, with an oval black patch posteriorly on dorsum and containing a small oval pea-green centre posteriorly; hairs on either side of thorax posteriorly brownish red. Abdomen ochreous, dorsum black-red, narrowing posteriorly, anal 3rd ochreous. Forewings with costa rounded, apex acute, hindmargin gently rounded, bright pea green; costal margin with a brown-red border freely irrorated with ochreous scales; a black-red basal fascia: an ochreous-green line from $\frac{2}{5}$ costa to $\frac{1}{3}$ inner margin, expanded to enclose three black red spots, one at costa, second almost touching first, and third on inner border: a

2nd line $\frac{3}{4}$ costa to anal angle, with an oblong attenuated spot on costa, a second rhomboid spot almost touching, and a minute dot close to hindmargin at $\frac{4}{5}$; a black red spot in apex of wing; a terminal hindmarginal black-red line, expanded into dots on veins: cilia reddish-ochreous, with reddish dots and a black red spot at $\frac{2}{5}$. Hindwings coloured as forewings; a broad ochreous line from apex of costa to $\frac{4}{5}$ hindmargin, bordered externally by a black-red line, broadened at apical angle into an elongated spot, into another elongated line or succession of dots just before hindmargin; a hindmarginal black-red line, in some interrupted, and bordering but separated from a black-red angular spot at vein 4, in some specimens diffused over anal angle and extending round inner margin, in others more or less absent; cilia ochreous with black-red dots opposite spots, on inner margin whitish-ochreous, anal half reddish-brown.

Cairns, and Dawson River (Mr. Barnard).

This differs from *A. lycænaria* in the fascia being narrow, differently distributed, and in the absence of the broad band on hindmargin. It is also allied to *A. lætata*, Fab.

HYPOCHROMA AURANTIACEA, sp.nov.

♂. 40 mm. Palpi blackish-grey. Antennæ dark grey. Head grey. Thorax grey, with darker spot in centre anteriorly. Abdomen blue-grey, with short black lines on either side of dorsum on each segment, yellow laterally, yellow on underside. Forewings with costa nearly straight, hindmargin gently rounded, blue-grey with darker grey, smoky and black scales and suffusions; lines black, a waved line close in to base; a diffused line at $\frac{1}{6}$ inner margin becoming obscure just before costa at $\frac{1}{6}$; a fine rich black line dentate and wavy from $\frac{1}{4}$ costa to $\frac{1}{3}$ inner margin; a second rich black fine line from $\frac{2}{3}$ costa, dentate to half across wing, thence sharply twice angulated toward base and thence again dentated to $\frac{1}{2}$ inner margin, a short line branches from centre of this line to just before costa at $\frac{1}{2}$; two suffused grey wavy lines beyond this and parallel to hindmargin, a fine black sub-marginal

crenate line; costa and inner margin darker suffused-grey: cilia grey. Hindwings as forewings, with basal half of inner margin yellow: a wavy crenulate line from $\frac{1}{3}$ costa to $\frac{1}{2}$ inner margin, a crenate sub-marginal finely defined black line, a suffused not distinct line at $\frac{1}{5}$, and another suffused indistinct line before the sub-marginal line—wing with dark suffusions toward base; cilia grey. Undersurface: forewings orange at base attenuated toward apex beneath costa; costa grey with black dots, a deep band of black filling outer third of wing, with apex grey and cilia grey; and three or four small grey dots near inner margin, a triangle of white, subtended by costa, and upper half of black band, occupies upper half of wing beneath costa and contains a deep black spot near its base: between this and inner margin a triangle of smoky-grey, inner margin lighter grey. Hindwing orange in basal half, outer half deep black bordered on either side with light-grey.

Brisbane; two specimens on trees.

Allied to *H. muscosaria*, but the sharp defined markings and the orange of the body and hindwings readily distinguish it.

HYPOCHROMA DIFFUNDENS, sp.nov.

♂. 30 mm. Head, thorax, and abdomen smoky-grey. Antennæ black. Legs irrorated black and white. Forewings with costa sinuous, apex acute, hindmargin crenulate; grey with white scales predominating near the centre, brown scales near the base, and smoke-colour scales on hind border, costa smoke-coloured, with numerous minute grey and black dots. an indistinct grey transverse line near base. a rich black line from $\frac{1}{4}$ costa to $\frac{2}{5}$ inner margin, curved outwards anteriorly and inwards posteriorly: immediately beyond this is a smoke-colour line, then an elongated linear discal spot, and again a fine rich black line from $\frac{3}{4}$ costa to just before anal angle of inner margin, twice curved outwards and dentate in centre: this line is bounded on outer edge by a fine white line: a second dentate white line just beyond $\frac{5}{6}$ costa to half way across wing, where it is submerged in a series of smoky-grey spots, which extend from costa just beyond to anal angle of inner

[redacted]

margin ; hindmarginal line fine black : cilia alternately grey and white. Hindwings as forewings, basal line indistinct : 2nd line indistinct smoky-grey : discal spot rich black, elongated : 3rd line fine rich black, from $\frac{2}{3}$ costa to just before anal angle of inner margin, twice waved ; veins smoky-grey ; hindmarginal line rich black ; cilia as forewings. Undersurface white-grey : discal spot an elongated black line : a fascia in posterior third bounded by fine rich black line on inner side, contains rich black suffused spot on inner third, but diffused smoky-grey toward hindmargin, where it is bordered by black marginal line. Hindwings, discal spot a deep black lunule : fascia in posterior third deep black bordered by black line anteriorly and indented in centre with veins deeper black, and enclosing on posterior border dark and light grey spots ; hindmarginal line black.

Dawson River ; one specimen (Mr. Barnard).

Family MONOCTENIADÆ.

XENOMUSA METALLICA, sp.nov.

♂. 32 mm. Palpi and antennæ fuscous-ochreous. Head, thorax, and abdomen ochreous-brown. Forewings, costa arched, hollowed in middle and arched to a point at apex ; hindmargin arched and rounded, ochreous-brown, with fulvous and smoky scales, and a general bronzy metallic gloss. Two fine fulvous-grey lines, 1st from inner margin just beyond base to just before costa at $\frac{1}{3}$, thence sharply angulated to costa at $\frac{1}{4}$; a very fine discal point beyond angle towards 2nd line ; 2nd line from $\frac{2}{5}$ inner margin to just before costa at $\frac{3}{4}$, thence more obliquely to costa at apex ; costa with a fine smoky line from $\frac{1}{2}$ to $\frac{4}{5}$; a smoky-grey spot at apex, and a smoky diffusion from 2nd line at near $\frac{3}{4}$ costa to anal angle : cilia smoky-brown. Hindwings with colours as forewings, with 1st line from $\frac{1}{3}$ costa to $\frac{1}{3}$ inner margin ; small smoke-diffused discal point, and 2nd line very faint or wanting ; cilia smoky-brown.

Brisbane ; one specimen ; at light.

Some five years ago I obtained a few specimens of *Xenomusa* which Meyrick named *X. monoda*, on the flowers of a shrubby verbena in a garden at Upper Moe, Gippsland, Victoria, at a height of 1200 feet. I have not found it here, though it is highly probable I may. But in its place I have obtained this allied species, which is smaller and distinctly metallic.

MONOCTENIA DIGGLESARIA, Gn.

Of this species Meyrick says: "I have seen no insect agreeing with it; it appears to indicate a good and distinct species." I have received a specimen from Mr. Kershaw, which exactly answers to Guenée's description.

Family MICRONIADÆ.

ANTEIA CANESCENS, sp.nov.

♀. 26-31 mm. Head black. Palpi grey, very short. Antennæ white. Thorax and abdomen grey white. Forewings with costa rounded, hindmargin gently rounded; white, sparingly dusted with grey scales, and numerous short water-grey strigulæ, costa thickly covered on basal $\frac{2}{3}$ with minute strigulæ; 1st fascia water grey, broad, from $\frac{1}{4}$ inner margin not reaching to costa opposite to $\frac{5}{6}$, attenuated toward costa, darker toward borders; 2nd fascia from $\frac{1}{3}$ inner margin to near costa just before apex, attenuated toward costa and with white patches in median line; an interrupted strigulous crossed line from $\frac{3}{4}$ inner margin to before apex, a 2nd like line from just before anal angle of inner margin to a point just before apex of costa with 2nd fascia and 1st line; a hindmarginal line black from near apical angle to two-thirds wing, thence diffused grey: cilia white, edged with grey. Hindwings as forewings, 1st and 2nd fasciæ in a direct line with those on forewings; 1st near base, 2nd from $\frac{1}{2}$ inner margin to $\frac{1}{2}$ costa; a third fascia from $\frac{3}{4}$ inner margin to $\frac{4}{5}$ costa, attenuated at both extremities; two sub-marginal lines from near anal angle of inner margin, interrupted in short wavy strigulæ,

to a point just before apical angle ; vein 4 bent to angle with a black spot ; cilia as forewings.

Rockhampton ; two specimens (Mr. G. Barnard).

Group NOCTUINA, Family AGARISTIDÆ.

AGARISTA ALBAMEDIA, sp.nov.

♀. 52 mm. Head black with white spots on either side of eye and behind origin of antennæ. Palpi black, white laterally. Antennæ black and white finely annulated. Thorax black with white dots anteriorly. Abdomen black, base of segments grey. Forewings, costa slightly sinuous nearly straight, hindmargin rounded; black with scattered minute white scales, chiefly near the base; a white fascia from $\frac{3}{5}$ costa, contracted in middle of wing, thence extended in two oblong dots, and thence in a round dot to just before, but not touching hindmargin at $\frac{3}{4}$: a few white very fine short lines almost imperceptible from costa at $\frac{5}{6}$ to hindmarginal end of median fascia, apex of wing rounded, with white margin : cilia black. Hindwings black, median white band broad from $\frac{4}{5}$ inner margin for three-fourths extent of wing to opposite to $\frac{2}{3}$ costa; apex of wing rounded, with white margin, divided by a dentate black prolongation into two portions ; cilia black.

Brisbane; one specimen (Mr. Illidge): Hills near Duaringa (Mr. Barnard).

AGARISTA SIMPLEX, sp.nov.

♂. 60 mm. Head black, spots at base of antennæ white. Palpi and antennæ black. Thorax black, with white dot on dorsum and on either side anteriorly. Abdomen black, tuft orange. Forewings elongate, costa rounded, hindmargin obliquely rounded, black with a median broad white band, from near but not touching costa at $\frac{1}{2}$ to $\frac{3}{4}$ extent of wing toward anal angle: cilia black. Hindwings black with a very fine white linear margin; cilia white.

Queensland ; one specimen.

This differs from *A. Latinus* in the median white band of forewings, which is short, stumpy and straight-edged (not indented or crenulate as in *Latinus*), and not extending to inner margin; there is not a white band with black dots as in *Latinus*, but only a very fine white linear margin. This may turn out to be a very striking variety of *Latinus*, but the wings all appear narrower and the markings are quite different.

AGARISTA TROPICA, sp. nov.

♂♀. 46-58 mm. Head black with brick yellow dots on either side of eyes and at base of antennæ. Palpi black, red yellow laterally, and fringed with black hairs beneath. Antennæ black and yellow annulated. Thorax black, with base of epaulettes yellow. Abdomen, anterior third black, posterior two-thirds orange with base of segments narrowly black. Forewings, costa rounded, hindmargin obliquely rounded, black, with brick-yellow markings; costa with fine yellow edge near base, and fine white margin at apex; twelve brick yellow spots arranged as follows: an arrow-shaped one in centre of wing near base, a triangle between its posterior portion and costa, a square just beyond and opposite costa at ½, a group divided by black veins into three oblong spots between this and hindmargin, a rhomb divided into two oblong spots by black veins between these and costa and opposite ¾ costa, similar twin spots and oblong between these and middle of hindmargin, and twin rounded spots near costa just before apex; these latter are paler and of a blue tinge; a row of hindmarginal white dots between veins; cilia black. Hindwings with basal fifth, a linear costal border, a broad hindmarginal border, and an oblong prolongation from costa at ⅓ to vein 4, black; middle third of wing orange or brick yellow, irregularly dentate into the black of both borders, with black veins and the black prolongation from costa very conspicuous; sub-marginal dots white; cilia black.

This differs from *A. Donovani* in many particulars; the number of spots in that species is 8, arranged in three couples and two

single spots, with two to four lighter dots or shadings present or absent. The spots in this species are larger and of a different colour to those in *A. Donovani*, which are ochreous-white. The median band on the hindwings is as broad again in *A. tropica* as in *Donovani*, and has a *median black elongation subtended from costa*, which is absent in *Donovani*. The abdomen is different, the segments in *Donovani* being broadly black and narrowly ochreous-white, the anal segment orange dotted with black, while in *A. tropica* the anterior third is deep black, with the posterior segments deep orange narrowly based with black.

Tropical Queensland.

A. DONOVANI, Melbourne to Cape York.

AGARISTA CÆRULEOTINCTA, sp.nov.

♀. 36 mm. Head black, cream-colour round orbits. Palpi and antennæ black. Thorax black, with grey tufts anteriorly. Abdomen grey with linear grey tufts anteriorly and black bands through segments. Forewings, costa straight or slightly sinuous, hindmargin rounded; black with a purplish tinge and a few small blue spots over basal fifth : a white discal spot just before $\frac{1}{2}$ and nearer costa than inner margin, a white fascia divided into six spots by black veins, from $\frac{2}{3}$ costa to $\frac{2}{3}$ the depth of wing towards anal angle, the costal spot is elongated and with a grey or bluish tint; a minute speck near costa at $\frac{4}{5}$ and another immediately beyond, subtending two rows of minute white-blue dots on veins extending and meeting in anal angle of inner margin, and a linear dash of white at apical extremity of hindmargin : cilia white irrorated with purplish-brown. Hindwings rich black with a linear streak of blue in centre of base, and extending for fully a third the expanse of the wing; there are two white spots with a blue tinge, the smaller near the $\frac{1}{2}$ of inner margin, and the larger in the centre of the wing; there is a row of marginal white linear spots; cilia black, but white subtending white spots. Underside, base of wings to $\frac{1}{4}$ bright blue.

Mackay (Mr. Turner). Allied to *A. Semyron*, H. Sch., of Sumatra.

Family OPHIUSIDÆ.

OPHIODES PARCEMACULA, sp.nov.

♂♀. 65 mm. Head, thorax, and abdomen light ochreous. Palpi black-brown. Antennæ black. Forewings elongate, costa straight, apex rounded, hindmargin straight, light ochreous; a minute black spot at $\frac{1}{4}$, a deep black discal spot at $\frac{1}{2}$, a row of minute black dots between veins from $\frac{3}{4}$ costa to two-thirds across wing to opposite $\frac{2}{3}$ inner margin: a large black lunule at $\frac{5}{6}$ costa, subtending a curved line of brown aggregations of dots to $\frac{4}{5}$ inner margin, a sub-marginal line of minute dots, and a marginal faint brown line beyond: cilia ochreous brown, with darker line at base. Hindwings ochreous-brown, shiny and tinted with ferruginous, with a deep black fascia from apex of costa extending to one-third along, but not touching hindmargin.

Brisbane and Dawson River.

This species comes near to *O. disjungens*, Walk., but it is a smaller insect, and differs in its uniformity of colour, the thorax, abdomen, and wings being a light ochreous, while in *disjungens* the thorax and forewings are dark fuscous, and the abdomen and hindwings orange. The markings in *parcemacula* are fewer, and the lines are differently distributed, while the hindmarginal band in the hindwings is scant in *parcemacula*, as compared to the broad band in *disjungens*, and which, in that species, extends to fully $\frac{3}{4}$ of hindmargin.

Family EUCLIDIDÆ.

FODINA GLORIOSA, sp.nov.

♀. 24 mm. Head black, annulet ochreous. Palpi black. Antennæ grey, ochreous beneath. Thorax black with a median transverse line and a line posteriorly ochreous, epaulettes black. Abdomen orange-ochreous, with a black spot on dorsum at base. Forewings triangular, dilate, costa slightly wavy, hindmargin nearly straight, reddish-ochreous with black markings: border of costa for basal $\frac{2}{3}$ ochreous, freely dusted with black scales and

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edged with black line, in apical $\frac{2}{5}$ red-ochreous: a basal triangle of rich black, apex not touching costa at $\frac{1}{5}$, bordered on inner half by red-ochreous: a rich velvet-black patch is joined to basal triangle on inner margin, thence free to just before $\frac{1}{2}$ costa, where it bends over to just before $\frac{3}{4}$ inner margin, twice denticulate outwards and a lunar excavation inwards in middle third; a triangle with base almost touching costa at $\frac{1}{2}$ to $\frac{3}{5}$ reaches to two-thirds of wing obliquely towards anal angle: a broad sub-marginal band from close to costa beyond, narrowing toward anal angle: the ground-colour between these two patches is brick-red bordered with ochreous: a hindmarginal black line broadened into dots on the veins, bordered posteriorly by brick-red: cilia red and grey. Hindwings brick-red, with red-orange suffusion over anal half of hindmargin: a broad hindmarginal black band attenuated and divided toward anal angle into two lines, marginal one to vein 4 and enclosing a line of red-orange: a large black spot on inner margin close to but not touching hindmarginal line; cilia red and grey.

Duaringa; one specimen (Mr. Barnard.)

Group PYRALIDINA, Family PYRALIDIDÆ.

ENDOTRICHA CROBULUS, sp.nov.

♂♀. 15-22 mm. Head golden. Palpi orange-brown. Antennæ ochreous-grey. Thorax fulvous. Abdomen dark fulvous. Forewings, costa straight, hindmargin gently rounded, chocolate-red with golden-yellow lines; costa with light minute yellow dots over middle two-fourths; basal fourth of wing darker chocolate, bounded by a golden line bordered on either side by chocolate black lines; middle two-fourths of wing lighter chocolate with small black discal spot, bordered with ochreous; a golden-yellow line from $\frac{3}{4}$ costa to $\frac{4}{5}$ inner margin, outwardly dentate in middle and bounded on either side by narrow black line; hindmarginal line golden-yellow: cilia golden-yellow. Hindwings as forewings, central third lighter chocolate with three light ochreous and

golden alternating lines; hindmarginal band and cilia golden orange.

Peak Downs and Rockhampton (Mr. G. Barnard).

Endotricha dispergens, sp.nov.

♂♀. 22-26 mm. Head, palpi, thorax, abdomen, and legs reddish-chocolate. Patagia in ♂ very elongated. Antennæ ochreous-brown. Forewings with costa rounded, in ♂ square on apical fourth as if cut off, hindmargin rounded, red-brown intermixed with chocolate and purple, and freely dusted with minute black scales, costal edge interruptedly annulated with ochreous and black-brown dots, discal spot of diffused black near costa at $\frac{2}{3}$, a black line from $\frac{1}{4}$ costa to $\frac{1}{3}$ inner margin, lighter toward inner margin; cilia chocolate-grey. Hindwings purplish-brown, redder toward costa and lighter ochreous-red toward base; in ♂ a line tinted with black scales from $\frac{2}{3}$ costa to $\frac{1}{2}$ inner margin, in some specimens not very distinct, in ♀ there are two blackish lines from $\frac{1}{4}$ costa to just before $\frac{1}{2}$ inner margin, and from $\frac{3}{4}$ costa to $\frac{3}{4}$ inner margin plainer than line in ♂; cilia as forewings.

The ♀ is like some specimens of *E. pyrosalis* in general appearance, but is differently marked, the ♂ is specially distinct by the square tip of forewings.

Scrub near Brisbane; very rare.

Œdematophora cacaalis, sp.nov.

♂♀. 18-20 mm. Head, antennæ, thorax, and abdomen light cinnamon brown. Palpi chocolate-red, long, ascending. Legs deep chocolate-red, lighter beneath. Forewings elongate, triangular, costa slightly arched in middle, hindmargin obliquely rounded, light cinnamon-brown dusted with fine black scales, and having apical third deep chocolate, narrowed toward anal angle of hindmargin; costal edge with minute chocolate dots, more scanty towards base, an indistinct darker brown mark extends from $\frac{1}{3}$ costa to $\frac{1}{3}$ inner margin: cilia deep chocolate. Hindwings light cinnamon-brown, crossed at regular distances by three black lines, the outer one being the least distinct; cilia purple-brown.

Brisbane; three specimens.

NOTES AND EXHIBITS.

Mr. C. Darley exhibited some very large examples of the shells of the mud oyster (*Ostræa edulis* var. *angasi*) obtained during dredging operations in Rozelle Bay, Sydney Harbour. They occur in great numbers at a depth of 10-12 feet below low water-mark beneath a layer of black mud 3-4 feet thick; and are much larger than specimens now to be found living in the harbour; the two valves of one pair weigh 3lbs. 12ozs., and measure about 8 × 6 inches. Mr. Darley also exhibited portions of the shell of *Voluta magnifica*, recently picked up by him on one of the northern beaches, and presenting numerous superficial borings and channellings made by some undetermined organism.

Mr. Maiden exhibited samples of the kino of *Angophora intermedia* and *A. lanceolata* in illustration of his paper.

Mr. Fletcher showed a number of Batrachians referred to in his paper.

Mr. Froggatt exhibited a collection of insects, including about 200 species of Coleoptera, from the Ballarat district, Victoria, collected during the months of March, April, and May.

Also specimens of a rare saw-fly, *Perga affinis*, Kirby, likewise from Ballarat, and, for comparison with it, specimens of *P. dorsalis*, Leach, the common Sydney species to which it is closely allied.

WEDNESDAY, 29TH JULY, 1891.

The President, Professor Haswell, M.A., D.Sc., in the Chair.

Dr. C. J. Martin and Mr. W. S. Dun were introduced as visitors.

The Chairman directed attention to the proposed arrangements for the next meeting of the Australasian Association for the Advancement of Science to be held at Hobart in January, 1892, as set forth in a printed programme, copies of which were laid on the table.

DONATIONS.

"Agricultural Gazette of N.S.W." Vol. ii., Parts 5 and 6 (May and June, 1891). *From the Director of Agriculture.*

"Victoria—Annual Report of the Secretary for Mines for 1890." *From the Secretary for Mines.*

"Proceedings of the Zoological Society of London for the year 1890." Part 4; "Abstracts," 5th May and 2nd June, 1891. *From the Society.*

"Bulletin de la Société Belge de Microscopie." xviiime Année, Nos. 6 and 7 (April, 1891). *From the Society.*

"Calendar of the University of Sydney for the year 1891." *From the University.*

"Catalogue of Fossil Cephalopoda in the British Museum" (Nat. Hist.). Part ii. (1891). By A. N. Foord, F.G.S.; "Catalogue of Fossil Fishes in the British Museum." Part ii. (1891). By A. S. Woodward, F.G.S., F.Z.S. *From the Trustees.*

"Journal of Conchology." Vol. vi., Nos. 9-10 (Jan. and April, 1891). *From the Conchological Society of Great Britain.*

"Zeitschrift der Gesellschaft für Erdkunde zu Berlin." Band xxvi., No. 2 (1891). *From the Society.*

"Mittheilungen aus der Zoologischen Station zu Neapel." ix. Bd., 4 Heft (1891). *From the Director.*

"Abhandlungen herausgegeben von der senckenbergischen naturforschenden Gesellschaft. xvi. Bd., 2 Heft (1890). *From the Society.*

"Records of the Australian Museum." Vol. i., No. 7 (June, 1891). *From the Trustees.*

"Transactions of the Royal Society of Victoria." Vol. iii., Part 1 (1891). *From the Society.*

"Zoologischer Anzeiger." xiv. Jahrg., Nos. 364-365 (May-June, 1891). *From the Editor.*

"Perak Government Gazette." Vol. iv., Nos. 13-17 (May-June, 1891). *From the Government Secretary.*

"Department of Agriculture, Brisbane—Bulletin." No. 9 (May, 1891). *From the Colonial Botanist.*

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"The Victorian Naturalist." Vol. viii., Nos. 2-3 (June-July, 1891). *From the Field Naturalists' Club of Victoria.*

"Bulletin de la Société Impériale des Naturalistes de Moscou." Année 1890, No. 4; "Beilage zum Bulletin." 2^{me} Série, T. iv. (1891). *From the Society.*

"Journal of the Bombay Natural History Society." Vol. vi., No. 1 (1891). *From the Society.*

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"Records of the Geological Survey of India." Vol. xxiv., Part 2 (1891). *From the Director.*

"The American Naturalist." Vol. xxv., No. 292 (April, 1891). *From the Editors.*

"Johns Hopkins University Circulars." Vol. x., Nos. 89 and 90 (June, 1891). *From the University*

"The Australasian Journal of Pharmacy." Vol. vi., No. 67 (July, 1891). *From the Editor.*

"The Pharmaceutical Journal of Australasia." Vol. iv., No. 7 (July, 1891). *From the Editor.*

"Proceedings of the United States National Museum." Vol. xiii., Nos. 836, 840 and 841 (1891). *From the Director.*

"Papers and Proceedings of the Royal Society of Tasmania for 1890." *From the Society.*

"Bulletin de la Société Zoologique de France pour l'Année 1891." T. xvi., No. 4 (April, 1891). *From the Society.*

"Records of the Geological Survey of N.S.W." Vol. ii., Part 3 (1891). *From the Hon. the Minister for Mines.*

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THE SILURIAN TRILOBITES OF NEW SOUTH WALES, WITH REFERENCES TO THOSE OF OTHER PARTS OF AUSTRALIA.

By R. Etheridge, Junr.—Palæontologist to the Australian Museum, and Geological Survey of N. S. Wales—and John Mitchell, of the Public School, Narellan.

Part I.

(Plate xxv.)

Introduction.

In this and following papers, we purpose, as stated in a late communication to this Society,* to give descriptions of the Silurian Trilobites of New South Wales, with passing references to those found in other parts of Australia. In the paper referred to we briefly mentioned the sources of our material. We shall endeavour to comprise the whole of the species of one genus within the compass of each paper, both as a means of comparison *inter se*, and with the view of convenient subdivision of the subject. Unless otherwise stated, the figured specimens are all taken from the collection of one of us.

We commence with the family Proetidæ.

Family PROETIDÆ.

Our knowledge of the Silurian Proetidæ of Australia is comprised in four descriptions of species by Sir F. McCoy, the late Messrs. de Koninck and Ratte, and one of us. The first-named naturalist described† from the Wenlock shale of Broadhurst Creek,

* Proc. Linn. Soc. N. S. Wales, 1890, v. (2), Pt. 3, p. 501.

† Prod. Pal. Vict., Dec. iii., 1876, p. 17, t. 22, f. 10, 10a.

near Kilmore, Victoria, a species under the name of *Forbesia euryceps*, which is peculiar from the great width of the cephalic shield, widely divergent genal angles, and the long spines attached thereto.

Prof. de Koninck referred three small pygidia from Yarralumla, N. S. Wales, to the British *Proetus Stokesii*, Murchison,* but the only distinctive character which can be seized on is the presence of six or seven axis rings. These tails probably belong to one or other of the forms described later, and not to *P. Stokesii* at all.

The late Mr. F. Ratte described† a Trilobite from Bowning, referring it to *Proetus ascanius*, Corda, as figured by Barrande This form will be discussed later on.

On two separate occasions a *Proetus* and a *Cyphaspis* have been described by one of us, the former as *P. bowningensis*,‡ from the Lower Trilobite Bed at Bowning, the latter as *C. bowningensis*,§ from the same locality and similar horizon. These will be forthwith re-described.

This, so far as we know, is an epitome of all that has been written on the Proetidæ of Australian Silurian rocks.

Genus PROETUS, Steininger, 1831.

(Mém. Soc. Géol. France, I., p. 355.)

The groups which have been proposed within the wider generic term *Proetus* are the following :—

1. PHÆTON, *Barrande*, 1846 Pygidium with the pleuræ produced into spines, forming a fimbriated circumference.
2. FORBESIA, *McCoy*, 1846. Genal angles produced into long spines; pleuræ of the pygidium segmented; glabella furrows present; and large tubercles terminating the neck-furrow.

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* Foss. Pal. Nouv. Galles du Sud, 1876, Pt. 1, p. 56.

† Proc. Linn. Soc. N. S. Wales, I. (2), p. 1066, t. 15, f. 1-4

‡ Proc. Linn. Soc. N. S. Wales, 1887, II. (2), Pt. 3, p. 439, t. 16, f. 4-6

§ Proc. Linn. Soc. N. S. Wales, 1887, II. (2), Pt. 3, p. 438, t. 16, f. 3.

3. Xiphogonium, *Corda*, 1847. Pleuræ of the pygidium unsegmented; nine segments to the thorax.

4. Celmus, *Angelin*, 1878. Two pairs of glabella furrows; twelve thoracic segments.

The non-acceptance of these terms by naturalists in general would seem to imply a difficulty in distributing the species under them. To us, however, *Phæton* appears a sound section of *Proetus*, and had any species occurred possessing its peculiar features we should have felt disposed to use it. Our inclination, also, would lead us to adopt Sir F. McCoy's *Forbesia*, were it not that the characters assigned appear to be more specific than even subgeneric. For instance, his *F. eurycepe* does not show two of the most important characters used for its generic separation—the neck tubercles and glabella furrows. Some *Proeti* have segmented pygidial pleuræ, without the presence of genal spines, *e.g.*, *P. bohemicus*, Barr.*; others again possess genal spines, but no glabella furrows, and a well-segmented pygidium, as, for instance, *P. lepidus*, Barr.†; a third species is provided with glabella furrows and genal spines, but the pleuræ of the pygidium are almost smooth; lastly, many species have well-developed neck lobes and genal spines, without the presence of neck lobes, and genal spines alone in the absence of glabella furrows, such as *P. Prouti*, Shumard, *P. Rowi*, Green, sp.‡ Under these circumstances, *Forbesia* does not appear to have sufficient stability to form even a sub-genus.

Proetus bowningensis, *Mitchell* (Pl. xxv., figs. 1, 1*a-c*).

Proetus bowningensis, Mitchell, Proc. Linn. Soc. N. S. Wales, 1887, I. (2), Pt. 3, p. 439, t. 16, f. 4-6.

Sp. Char.—Body subelliptical. *Cephalic shield* larger than the pygidium or thorax, equal in axial length to the pygidium, greater than the axial length of the thorax by the width of the neck ring and furrow; limb moderately wide, the margin thickened, flattened

* Syst. Sil. Bohême, 1852, I. Atlas, t. 16, f. 1-15.

† Syst. Sil. Bohême, 1852, I., t. 16, f. 28-30.

‡ Hall, Pal. N. York, Ill. Dev. Fossils, t. 21.

in front of the glabella, striated at the side of the free cheeks; glabella conoid, obtusely pointed forwards, very moderately convex, no lateral furrows visible; neck furrow narrow, straight; neck segment rather wide, gently arched, sub-tumid at each extremity; axial furrows rather faint; facial sutures from the eyes to the frontal margin straight, thence outwards at an angle of about 60°, curved posteriorly, and cutting the posterior margin about the middle of the side lobes of the cephalic shield; fixed cheeks small, with large eye-lobes; eyes large and crescentic; free cheeks moderately large, with a well defined and striated margin; genal angles continued into stout spines, which reach to and include the fourth pleura of the thorax. *Thorax* of nine segments, with rather straight lateral margins, length equal to the combined width of the pleuræ; axis at its anterior end much wider than the side lobes, posteriorly they are equal, moderately arched: segments inclined slightly forwards; axial grooves distinct and narrow; pleuræ moderately arched, distinctly grooved, the grooves widest medially, diminishing towards the proximal and distal ends. *Pygidium* large, subelliptical or triangular, proportion of width to length as about 16 : 14; axis prominent, terminated distally somewhat abruptly and obliquely, twice as wide at the proximal as the distal end; segmentation faint, of eight or nine rings; axial furrows moderately distinct; pleuræ five, wider than the axis, less arched than those of the thorax, and the first three pairs distinctly furrowed, limb wide, striate, and slightly thickened.

Obs.—Additional specimens enable us to form a much better idea of the structure of this Trilobite than when it was originally described. The principal characters of the species are a conoid glabella, ill-defined glabella furrows, moderately large genal spines, a thoracic axis of nine segments, the axis of the pygidium of eight or nine, and the pleuræ of the same five in number. The original specimen of *P. bowningensis* figured was one in which the mutilated cephalic shield was in the form of an impression, and the pygidium as a decorticated relief. The test of this shield is beautifully ornamented with anastomosing lines, which on the genal angles and base of the spines become concentric

and semi-imbricating. Similar sculpture exists in *Proetus decorus*, Barrande,* but the Trilobites do not otherwise agree. The normal number of ten thoracic segments is here departed from in favour of nine, a character which *P. bowningensis* possesses in common with the Bohemian species *P. sculptus*, Barr.,† and the American Devonian *P. longicaudus*. Another peculiarity exists in the rather long genal spines, which extend to and include the fourth thoracic segment, a feature which is, however, exceeded by some Bohemian species, as well as by *P. latifrons*, McCoy,‡ and one Australian form, *P. australis*, nobis. In *P. latifrons*, the genal spines reach as far as the sixth thoracic segment.

P. bowningensis does not closely resemble in its general specific characters any of the numerous Bohemian species, having too conoid a glabella and far too triangular a pygidium. *Proetus parviusculus*, Hall,§ of the Hudson River Group, is much like our Pl. xxv. fig. 1*c*. about the glabella, and generally in regard to the whole cephalic shield, but the outline of the pygidium is much too semicircular.

From *P. Rattei*, nobis, the present species is distinguished by the absence of the longitudinal sulci on the glabella of that form, and from *P. australis* by the almost circumscribed condition of the basal lobes. The large plain glabella and wide diverging genal spines separate the Victorian *P. euryceps*, McCoy,|| from our species at once.

Individuals from the Middle Trilobite Bed of the Bowning Series have a more prominent thoracic axis than those from the Upper Trilobite Bed, whilst the specimens obtained from the latter horizon have not been observed to possess anastomosing ornament.

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* Syst. Sil. Bohême, 1852, I., Atlas, t. 17, f. 13.

† Syst Sil. Bohême, 1852, I., Atlas, t. 15, f. 1

‡ *Forbesia*, Brit. Pal. Foss., Fas. 1, 1851, p. 174.

§ Hall and Whitfield, Report Geol. Survey, Ohio, II., Pt. 2, Pal., 1875, p. 109, t. 4, f. 18.

|| Prod. Pal. Vict., Dec. III., 1876, p. 17, t. 22, f. 10, 10*a*.

Loc. and Horizon.—Bowning Creek, Bowning, Co. Harden *(Coll. Mitchell)*; Middle and Upper Trilobite Beds of the Bowning Series—Upper Silurian (? Wenlock).

PROETUS RATTEI, *sp.nov.* (Pl. xxv., figs 2, 2*a-d*).

Proetus ascanius, Ratte (*non* Barrande), Proc. Linn. Soc. N. S. Wales, I. (2), Pt. 4, p. 1066, t. 15, f. 1-4.

Sp. Char.—Body oval and flattened. *Cephalic shield* large, semicircular, and slightly convex; limb wide, flattened, or slightly concave, with anastomosing striæ. Glabella short, square, and somewhat trilobed by two shallow longitudinal furrows, extending from the neck furrow to the front; basal pair of lateral furrows present, uniting the longitudinal furrows, and so dividing each lateral lobe into two; neck furrow distinct, narrow; neck segment wide, slightly convex about the middle; axial furrows rather faint, continuing round the front of the glabella; facial sutures anteriorly rather straight, and gently directed outwards to the margin, behind they cut the posterior margin at a distance from the glabella equal to that of one third the width of the thoracic pleuræ; fixed cheeks very small; free cheeks large, very moderately convex; genal angles continued into stout spines, directed outwards slightly from the thorax, and extending as far as the fourth segment of the latter. *Thorax* of eight segments, the axis and pleuræ at the anterior end being about equal in width, but posteriorly the latter are much the wider; lateral margins straight; axis flat or very slightly arched; pleuræ flat and bent backwards towards their outer ends, terminating in rather claw-shaped spines, those of the third pleuræ apparently longer than the others. *Pygidium* relatively large, about three-fourths as long as the head-shield, subsemicircular; axis conical, of eight rings, the terminal ones very faint; contracting rapidly to the margin of the limb, thence continuing to the circumference as an acicular ridge, axial furrow distinct; pleuræ eight, distinctly furrowed, the furrows extending across the limb to the circumference; limb wide, marked off by a faint concentric depression, and faintly striated with concentric wavy striæ.

Obs.—*Proetus Rattei* was figured and partially described by the late Mr. Felix Ratte, and provisionally referred to *P. ascanius*, Corda, but though the cephalic shield does to some extent agree with that of this species, as figured by Barrande,* there are differences which we consider sufficiently important to separate the two, and therefore beg to associate with it the name of our deceased friend.

The glabella in *P. Rattei* is much squarer than in *P. ascanius*, and approaches nearer to the hinder border of the limb. The longitudinal furrows also are longer, extending farther forward, whilst the basal lobe is smaller. At the same time, both Trilobites possess a great development of cephalic shield exterior to the glabella, and it was probably this, with the character of the furrows, which caused Mr. Ratte to make the reference to *P. ascanius.* Mr. Ratte appears to have copied Barrande's figures rather than the Australian fossils before him. *P. Rattei* is quite distinct from either of the other Australian species.

In some respects the pygidium of *P. Rattei* resembles that of *P. decorus*, Barr.,† but differs in being nearly semicircular instead of subtriangular. In the great proportionate size of the limb of the pygidium, our species approaches some forms of *Bronteus;* and in the short glabella and expanded cephalic shield it resembles *Arethusina.* On the other hand, the Proetiform characters of eight thoracic segments, and eyes close to the glabella, overbalance these peculiarities.

A similar acicular ridge to that at the posterior termination of the pygidium axis is also present in *Proetus corycœus*,‡ Conrad, a characteristic species of the Niagara Group. One of the most peculiar features in *P. Rattei*, and unobserved by us in any other species of the genus, is the enlargement of the pleural spine of the third thoracic segment. Is this a sexual character?

We have detected what we believe to be the larval condition. In the earliest stage the glabella is rudimentary, the eye exceed-

* Syst. Sil. Bohême, 1852, I., Atlas, t. 15, f. 41.
† Syst. Sil. Bohême, 1852, I., Atlas, t. 17, f. 13.
‡ Hall, Pal. N. York, II., t. 67, f. 13.

ingly small, the thoracic segments five in number, and the pygidium almost as large as the thorax and cephalic shield combined (Pl. xxv. fig. 2*d*). In the next stage the glabella is more fully developed, but the segments of the thorax remain the same in number.

Loc. and Horizon.—Bowning Creeek, Bowning, Co. Harden *(Coll. Mitchell)*; Lower Trilobite Bed of the Bowning Series—Upper Silurian (? Wenlock).

PROETUS AUSTRALIS, *sp.nov.* (Pl. xxv., figs. 3, 3*a-e*).

Sp. Char.—Body oval or elliptical. *Cephalic shield* semi-elliptical; axial length greater than that of the thorax, and much greater than that of the pygidium. Glabella rather short, squarish or subrectangular, moderately prominent, equal in length to the pygidium; basal pair of lateral furrows distinct, and nearly circumscribing the basal lobes; neck furrow moderately distinct; neck segment wide, gently arched; axial furrows moderately distinct and continuous in front of the glabella; facial sutures anteriorly straight to the thickened edge of limb, thence incurving along it, behind cutting the posterior margins of the shield at about one-third their distance from the axial grooves; fixed cheeks small: eyes moderately large and reniform; free cheeks large and somewhat tumid, genal angles produced into very long and gently incurved spines, which completely embrace the thorax; limb wide, with a thickened edge, and striated on the under surface, the shield between it and the anterior edge of the glabella being much flattened. *Thorax* of eight segments, width twice that of the length; axis moderately arched, tergal portion rather flat, almost twice as wide anteriorly as posteriorly, axial furrows distinct; pleuræ gently directed or curved backwards, terminating distally in short claw-shaped spines. *Pygidium* semi-elliptical, twice as wide as long; axis short, half the length of the pygidium, more or less in the form of a truncated cone; pleuræ flat, five or six in number, faintly furrowed; limb striated; surface presenting a faint appearance of granulation.

Obs.—*Proetus australis* is an interesting species, as by the nearly circumscribed basal lobes it shows a tendency to take on

the *Cyphaspis* type, in which it agrees with *P. decorus*, Barr.,* *P. striatus*, Barr.,† *P. archiaci*, Barr.‡ It, however, retains its connection with *Proetus* by possessing eight thoracic segments.

The nearly complete isolation of the basal lobes also separates *P. australis* at once from *P. bowningensis* and *P. Rattei.*

The genal spines are of great length, embracing the whole of the thorax, a marked increase in this particular structure on that of *P. bowningensis* and *P. Rattei.* Herein *P. australis* agrees with *P. Loveni*, Barr.,§ and a similar length of spine occurs in *P. Stokesii*, Murchison, for McCoy‖ describes the genal spines of this species as extending to the pygidium, and thus embracing the whole of the thoracic segments.

Loc. and Horizon.—Bowning Creek, Bowning, Co. Harden *(Coll. Mitchell)*; Lower Trilobite Bed of the Bowning Series—Upper Silurian (? Wenlock).

In our next communication we shall treat of the Genus *Cyphaspis*.

EXPLANATION OF PLATE.

PROETUS BOWNINGENSIS, *Mitchell.*

Fig. 1. —A specimen wanting the free cheeks and genal spines.

Fig. 1*a*.—A similar one with less of the glabella preserved.

Fig. 1*b*.—A more or less complete individual.

Fig. 1*c*.—Side view of Fig. 1*b*.

PROETUS RATTEI, *Eth., fil., and Mitchell.*

Fig. 2. —The left half of a somewhat curved individual, showing the large third thoracic pleural spine, × 2.

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* Syst. Sil. Bohême, 1852, Atlas, t. 17, f. 13.

† Syst. Sil. Bohême, 1852, Atlas, t. 17, f. 46.

‡ Syst. Sil. Bohême, 1852, Atlas, t. 17, f. 42.

§ Syst. Sil. Bohême, 1852, Atlas, t. 16, f. 25 and 26.

‖ Brit. Pal. Foss., 1851, Fas. 1, p. 174.

PROTEUS RATTEI, *Eth., fil., and Mitchell (continued).*

Fig. 2*a*.—Cephalic shield and portion of thorax, the lateral portions of the former rather displayed, × 2.

Fig. 2*b*.—Remarkably small head of a young individual, × 5.

Fig. 2*c*.—Pygidium showing the surface sculpture and acicular termination to the thoracic axis, × 2.

Fig. 2*d*.—Larval form, × 5.

PROETUS AUSTRALIS, *Eth., fil., and Mitchell.*

Fig. 3. —A more or less perfect individual.

Fig. 3*a*.—Portion of a cephalic shield.

Fig. 3*b*.—A somewhat more perfect specimen than fig. 3, showing the long genal spines embracing the whole of the thorax, × 2.

Fig. 3*c*.—A glabella showing small basal furrows, × 2.

Fig. 3*d*.—A free cheek.

Fig. 3*e*.—Another free cheek, × 2.

ON THE SYNONYMY OF *HELIX (HADRA) GULOSA*, GOULD.

BY JOHN BRAZIER, C.M.Z.S., F.L.S.

The subject of this present contribution, *Helix* (*Hadra*) *gulosa*, Gould, was first obtained by me at Port Hacking and other places included in, and now known as, the National Park in 1859-1860; also between Cook's and George's Rivers, at places now called Kogarah, Rockdale, and Hurstville, then known as Gannon's Forest, and at Bulli Pass in 1864, 1865, 1866. Specimens were named and submitted in 1868 to Messrs. George French Angas and Henry Adams for identification, and were duly returned as identical with *H. gulosa* as defined by Gould in 1846. Gould's specimens were first obtained by Mr. J. Drayton, of the United States Exploring Expedition, in the Illawarra district in the year 1839, and were re-described by Pfeiffer in 1847 as *H. coriaria* from specimens reputed to have come from Ceylon. The shell was next characterised by Morelet in 1853, under the title *H. morosa*, as coming from Moreton Bay; and in 1859 Pfeiffer, under the name of *H. coriaria*, originally described from Ceylon by himself, in 1847, recorded this species as occurring in Western Australia. Gould, in the *Otia Conchologica* in 1862, p. 243, suggests a new generic name, *Badistes*, for his *H. gulosa*. In the same year this author also published an account of the occurrence of the species in Australia. In 1864 Dr. Cox re-described *H. gulosa* under two distinct specific designations, viz., *H. Mastersi* and *H. Scotti*, the former regarded by him as an intermediate form between *H. Grayi*, Pfr., and *H. Jervisensis*, Quoy and Gaimard.

Four years subsequently, 1868, Pfeiffer sinks *H. gulosa* as merely a synonym of *H. Lessoni*, disregarding Cox's supposed species.

Pfeiffer, in the *Nomenclator Heliceorum Viventium* in 1881 drops the specific name *gulosa* as synonymic with *Lessoni* from Port Curtis and reinstates the species under the sub-generic title *Badistes*. Paetel, in his *Catalog der Conchylien-Sammlung*, 1889, makes *H. gulosa* synonymic with *Lessoni*, Pfr. The latest published account of this species in question is that by Mr. H. A. Pilsbry, in Tryon's *Manual Conchology* (second series *Pulmonata*, vol. VI., 1890), where this author evidently is inclined to regard *H. coriaria*, *H. Scotti*, *H monacha*, and *H. morosa* as merely varietal forms of the original *H. gulosa*, Gould.

In the following paper I have enumerated a complete synonymy of *H. gulosa*, Gould ; and from the examination of a very large number of specimens, both living and dead, I cannot hesitate to confirm Pilsbry's surmise that *H. coriaria*, *H. Scotti*, *H. monacha*, *H. morosa* are undoubtedly identical with *H. gulosa*, Gould. It is some years since I came to the conclusion that Dr. Cox's species, *Mastersi* and *Scotti*, were not good species. According to Drayton, as mentioned by Gould (*U. S. Exploring Expedition*, vol. XII. p. 65, 1852), the living animal does not glide from place to place as other Helices, but proceeds by flexing the foot in an undulating manner, and on this account Gould, in 1862, bestowed upon the species the sub-generic name *Badistes*. Having examined many hundreds of living specimens, both in their natural haunts and in confinement, I am compelled to contradict the statement that this mollusc "flexes the foot;" it moves in the ordinary gliding manner. I find that I made a marginal note to this effect in 1879 in a copy of Gould's *Otia Conchologica*, kindly presented to me by my valued friend and correspondent, Mr. John Howland Thomson, C.M.Z.S., New Bedford, U.S.A. Consequently, as pointed out by me to my young friend, Mr. Chas. Hedley, who has lately commenced to write upon the Australian Land Mollusca, and is about to publish an account of the anatomy of this species, the sub-genus *Badistes* has been created under an erroneous impression, and in my opinion *H. gulosa*, Gould, is attributable to the old sub-genus *Hadra*, as placed by Pilsbry. I have seen specimens of this species exhibited

before this Society as large varieties of *H. Grayi*, Pfr., from Bottle Forest.

Hanley and Theobald, in their *Conchologia Indica*, state that Australian specimens cannot be distinguished from the shell delineated in their figure; to my eye the figure indicates dwarf specimens found by me on Comerong Island, Shoalhaven. The species may have been introduced into the Island of Ceylon in boxes of plants taken from New South Wales, specimens having, perhaps, been sent by the late Sir William Denison, when Governor of N.S.W., to the Indian Museum, as that gentleman was constantly contributing specimens to the Indian colony.

HELIX (HADRA) GULOSA, GOULD.

1846. *Helix gulosa*, Gould, Proc. Boston Soc. Nat. Hist., vol. II. p. 165; Expedition, Shells, p. 17

1847. *H. coriaria*, Pfeiffer, Zeitschr. f. Mal., p. 145

1847. *H. coriaria*, Pfeiffer in Martini and Chemnitz Conch. Cab., 2nd edition (Kuster), p. 265, pl. 120, fig. 1-2

1848. *H. gulosa*, Gould, Pfeiffer in Monogr. Hel. Viv., Vol. I. p. 339

1848. *H. coriaria*, Pfeiffer, Monogr. Hel. Viv., Vol. I. p. 445, sp. 501A

1852. *H. gulosa*, Gould, United States Exploring Expedition, Mollusca and Shells, Vol. XII. pp. 64, 65, pl. 3, fig. 43, animal with shell; 43A, the aperture; 43B, the base of the shell

1852. *H. gulosa*, Gould, Forbes in Appendix to Macgillivray's Voyage of H.M.S. Rattlesnake, Vol. II. p. 370, No. 32

1852. *H. coriaria*, Reeve in Conch. Icon., Helix, Vol. VII. pl. 79, fig. 417

1853. *H. gulosa*, Gould, Pfeiffer in Monogr. Hel. Viv., Vol. III. p. 229, No. 1302

1853. *H. morosa*, Morelet, Journal de Conchyl., Vol. IV. p. 369, pl. 11, fig. 15

1853. *H. coriaria*, Pfeiffer, Monogr. Hel. Viv., Vol. III. p. 150, No. 795

1855. *Lucerna (Serpentulus) gulosa*, H. and A. Adams, Genera of recent Mollusca, Vol. II. p. 201

1859. *H. coriaria*, Pfr., Tennent, Ceylon, an Account of the Island—Physical, Historical, and Topographical—with Notices of its Natural History, Vol. I. p. 238

1859. *H. coriaria*, Pfeiffer, Monogr. Hel. Viv., Vol. IV. p. 167, No. 1049

1859. *H. gulosa*, Gould, Pfeiffer in Monogr. Hel. Viv., Vol. IV. p. 248 , quotes it as a synonym of *H. Lessoni*, Pfr.

1859. *H. morosa*, Morelet, Pfeiffer in Monogr. Hel. Viv., Vol. IV. p. 248, No. 1599

1859. *H. monacha*, Pfeiffer, Proc. Zool. Soc. London, p. 25, pl. 43, fig. 7

1860. *H. (Hadra) morosa*, Albers, Die Heliceen, p. 166

1861. *H. coriaria*, Pfr., Tennent, Natural History of Ceylon, p. 391

1862. *H. gulosa*, Gould, Otia Conchologica, p. 17

1862. *H. (Badistes) gulosa*, Gould, Otia Conchologica, p. 243

1864. *H. monacha*, Cox, Catalogue of Australian Land Shells, p. 16, No. 77

1864. *H. gulosa*, Gould, Cox, Catalogue of Australian Land Shells, p. 18, No. 97

1864. *H. Mastersi*, Cox, Annals and Mag. Nat. Hist., 3rd series, Vol. XIV. p. 181, No. 6; Catalogue of Australian Land Shells, p. 19, No. 105

1864. *H. Scotti*, Cox, Catalogue of Australian Land Shells, p. 36, No. 119

1868. *H. coriaria*, Pfeiffer, Monogr. Hel. Viv., Vol. v. p. 236, No. 1428

1868. *H. Mastersi*, Cox, Pfeiffer in Monogr. Hel. Viv., Vol. v. p. 237, No. 1431

1868. *H. monacha*, Pfeiffer, Monogr. Hel. Viv., Vol. v. p. 278, No. 1785

1868. *H. gulosa*, Gould, Pfeiffer in Monogr. Hel. Viv., Vol. v. p. 320; quotes it as a synonym of *H. Lessoni*, Pfr.

1868. *H. morosa*, Morelet, Pfeiffer in Monogr. Hel. Viv., Vol. v. p. 320, No. 2117

1868. *H. Scotti*, Cox, Pfeiffer in Monogr. Hel. Viv., Vol. v. p. 340, No. 2230

1868. *H. (Pomatia) coriaria*, Cox, Monogr. Aust. Land Shells, p. 36, No. 92, pl. 2, fig. 7, pl. 8, fig. 10, pl. 10, fig. 5

1868. *H. (Pomatia) monacha*, Cox, Monogr. Aust. Land Shells, p. 38, No. 98, pl. 18, fig. 13, from Proc. Zool. Soc. London, 1859

1868. *H. (Camæna) morosa*, Cox, Monogr. Aust. Land Shells, p. 60, No. 151

1868. *H. (Pomatia) Scotti*, Cox, Monogr. Aust. Land Shells, p. 39, No. 100, pl. 10, fig. 4, 4A

1869. *Galaxias monacha*, Frauenfeld, Verh. k.-k. Zool. Bot. Ges. Wien, p. 875

1876. *H. coriaria*, Pfeiffer, Monogr. Hel. Viv., Vol. VII. p. 272, No. 1803

1876. *H. monacha*, Pfeiffer, Monogr. Hel. Viv., Vol. VII. pp. 322, 579, No. 2227

1876. *H. coriaria* (var.), Hanley and Theobald, Conchologia Indica, Land and Fresh Water Shells of British India, p. 25, pl. 53, fig. 10

1876. *Fruticola coriaria*, Theobald, Catalogue of the Land and Fresh Water Shells of British India, p. 25

1876. *H. gulosa*, Gould, Pfeiffer in Monogr. Hel. Viv., Vol. VII p 367 ; quotes it as a synonym of *H. Lessoni*, Pfr

1876. *H. morosa*, Pfeiffer in Monogr. Hel. Viv., Vol. VII. p. 367, No. 2618

1876. *H. Scotti*, Cox, Pfeiffer in Monogr. Hel. Viv., Vol. VII. p. 394, No. 2788

1877. *H. coriaria*, Pfr., Monogr. Hel. Viv., Vol. VIII. p. 574

1878. *H. (Badistes) gulosa*, Gould, Pfeiffer in Nomenclator Heliceorum Viventium, p. 189 ; quotes it as a synonym of *H. Lessoni*, Pfr.

1888. *H. coriaria*, Cox, Handbook of Sydney, for the use of the members of the Australasian Association for the Advancement of Science, p. 84, No. 34

1888. *H. monacha*, Cox, Handbook of Sydney, for the use of the members of the Australasian Association for the Advancement of Science, p 84, No 35

1889. *H. (Pomatia) coriaria*. Paetel, Catalog der Conchylien Sammlung, p. 120

1889. *H. (Pomatia) monacha*, Paetel, Catalog der Conchylien-Sammlung, p. 157

1889. *H. gulosa*, Gld ist *Lessoni*, Pfr., Paetel, Catalog der Conchylien-Sammlung, p. 137

1890. *H. (Pomatia) gulosa*, Gould, Etheridge, junr., Records of the Australian Museum, Vol. I. No 1, p. 26

1890. *H. (Hadra) gulosa*, Pilsbry in Tryon's Manual of Conchology, second series, Pulmonata, Vol. VI. p. 131, pl. 33, figs. 66, 67

1890. *H. (Hadra) coriaria*, Pilsbry in Tryon's Manual of Conchology, second series, Pulmonata, Vol. VI. p. 132, pl. 43, figs. 48, 49, 51

1890. *H. (Hadra) Scotti*, Pilsbry in Tryon's Manual of Conchology, second series, Pulmonata, Vol. VI. p. 133, pl. 43, fig. 47

1890. *H. (Hadra) monacha*, Pilsbry in Tryon's Manual of Conchology, second series, Pulmonata, Vol. VI. p. 133, pl. 43, fig. 39

1890. *H. (Hadra) morosa*, Pilsbry in Tryon's Manual of Conchology, second series, Pulmonata, Vol. VI. p. 134, pl. 34, fig. 10

1890. *H. (Hadra) gulosa*, Pilsbry in Tryon's Manual of Conchology, second series, Pulmonata, Vol. VI. p. 304

1891. *Hadra gulosa*, Hedley (Anatomy), Records of the Australian Museum, Vol. I. No. 9, October, p. 196, pl. 29

Habitat.—Illawarra (*Mr. J. Drayton*, 1839); Port Hacking, Sutherland, 353; Heathcote, 626; Waterfall, 720-800 feet above sea level (*J. Brazier*, 1859-1860); Rockdale, Kogarah, Hurstville, 55, 69, 217 feet above sea level, Bulli Pass, 1000 feet (*J. Brazier*, 1864, 1865, 1866); Merimbula, Kiama, Ulladulla (*Mr. George Masters*, 1864, 1865, 1866); Moss Vale, Blue Mountains, 2205 feet above sea level (*J. Brazier*, 1865); Clarence River (*Mr. John Macgillivray*, 1865, 1866); Nullo Mountains, County of Hunter (*Mr. Edward King Cox*, 1867); gullies in Cabbage-tree Scrub at head of Waterfall Gully, Illawarra railway line, at base of ranges and gullies in the Mulgoa Valley, running into the Nepean River, Kurrajong (*Dr. James C. Cox*, 1868, 1888); Wingham, Upper Manning River (*J. Brazier*, June, 1870); Comerong Island, Shoalhaven River (*J. Brazier*, October, 1874); Blackheath, Blue Mountains, 3494 feet above sea level (*J. Brazier*, 1875); Erskine Valley, Nepean River (*J. Brazier*, 1864, 1866, 1888); Cambewarra (*Mr. T. Whitelegge*, 1885); Sassafras Tableland, 5000 feet above sea level (*Messrs. R. Etheridge, Junr.*, and *J. A. Thorpe*, August, 1889); Lawson, Blue Mountains, 2399 feet above sea level (*Mr. E. G. W. Palmer*, June, 1891); Kangaroo Valley, in ranges above the Shoalhaven River (*Messrs. J. A. Thorpe and C. Harris*); Ash Island, Hunter River (*Mr. Alexander Walker Scott*); Mount Keira, Wollongong, 1863 (*Mrs. Edward Forde*); Kiama (*Mr. Simeon P. Hitchcock*, August, 1891); flank of Mount Keira (*Mr. Simeon P. Hitchcock*, December 12, 1891).

The whole of these localities are in the colony of New South Wales. Doubtful localities: Ceylon (*Dr. Pfeiffer on the authority of Mr. Hugh Cuming*, 1847); Moreton Bay (*on the authority of Monsieur Morelet*, 1853); Western Australia (*Dr. Pfeiffer on the authority of Mr. Hugh Cuming*, 1859). The correct spelling of one of the localities is Nullo Hills, or Mountains, not "Nulla," as quoted by some authors.

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OBSERVATIONS ON THE *CHLORAEMIDAE*, WITH SPECIAL REFERENCE TO CERTAIN AUSTRALIAN FORMS.

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[Plates XXVI-XXVIII.]

The following notes have reference chiefly to a remarkable member of this family which occurs on the Queensland coast; but the opportunity has been taken to give some account at the same time of two other Chloraemids which have been found by the author in Port Jackson, and which have not hitherto been described.* A specimen of *Stylarioides monilifer* was investigated for comparison with the new species, and a few remarks on its structure will be found here and there in the following pages.

I. DESCRIPTION OF COPPINGERIA LONGISETOSA, n.g. et sp.

I have seen only two specimens of this remarkable Chaetopod. One was dredged in 1881 by Dr. Coppinger and myself in Port Molle, Queensland (lat. 20° S.), at a depth of 15 fathoms. The other was got long before by the Hon. Sir William Macleay during his expedition to Torres Straits and New Guinea in the "Chevert," and was dredged off Darnley Island. I have figured both of these specimens, as one is more complete in one respect and the other in another; and I find it advantageous to describe

* The only previously known Australian species of this family appears to be the *Siphonostomum affine* described by me in a paper published in the Proceedings of this Society. The same name had, unfortunately, been applied previously by Leidy to another species; but the latter, as pointed out by Grube, is probably a *Stylarioides*.

their external characters separately. The Port Molle specimen has been cut into sections; the Darnley Island specimen remains in the Macleay Museum, in the University of Sydney.

Specimen A (that from Port Molle) has, apparently, had a portion of the posterior extremity broken off. Otherwise it is admirably preserved—particularly as regards the branchiæ, the tentacles and papillæ. Specimen B is entire as regards the segments; but the praestomium has been broken off, and the branchiæ and tentacles are therefore lost.

Specimen A (plate xxvi. fig. 1).—The body is sub-cylindrical, tapering gradually posteriorly, the greatest breadth being at a little distance behind the cephalic extremity, where there is a slight dilatation. Round the latter is a circlet of sixteen very large setæ, which are nearly as long as the body, thick at the base, finely tapering, and slightly curved towards the distal end. They are marked transversely by fine transverse lines, giving them the appearance of being composed of a number of segments. In most cases there is situated close to the base of each large seta a very much smaller accessory seta. All the large setæ in this specimen, as in the other, have attached to them numerous individuals of a species of *Loxosoma*.

There are twenty-six segments in the body (from which the posterior portion has been broken off). The number of the segments can only be reckoned by counting the bundles of setæ, except in the case of a few of the most posterior, which are separated from one another by distinct constrictions. All the segments behind the head bear setæ; but the parapodia are not distinguishable. All, except the first seven, have dorsal and ventral sets of setæ separated from one another by a short space. The dorsal setæ alone are present in the first seven segments, or, at least, if ventral setæ are present in these segments, they do not project on the surface. In the first segment (behind those that bear the cephalic setæ) there are four very long and very fine dorsal setæ, stouter and longer than those of the succeeding segments, and directed forwards. The following segments,

except the first six, which have only dorsal setæ, have each a bundle of four fine, tapering dorsal setæ and three stouter, short ventral setæ, which are curved at the ends. (Plate XXVII. fig. 9.) The dorsal setæ are in fan-like groups directed forwards and outwards.

The body wall is tolerably firm. The surface is covered with closely-set papillæ, which vary in size, some being elongate, others very short; a number of those around the bases of the anterior large setæ are very long and slender, with slightly enlarged rounded ends: a detailed account of the papillæ is given further on.

The head (fig. 2) consists of a stout base, bearing distally a pair of tentacles, and a pair of branchiferous lobes. The base is 8 mm. in length, and at its posterior end is about half the thickness of the anterior part of the body, narrowing slightly towards its distal end; closely embraced behind by the bases of the ring of large anterior setæ and by the elongated papillæ; its surface is dotted over with papillæ similar to those covering the body, but smaller. It consists of the greatly produced peristomium surrounded, as by a sheath, by a thin prolongation of the first body-segment. The præstomium is produced in front laterally into the compressed bases of the branchiferous lobes; mesially in front is a small lobe bearing two pairs of eyes; in front of the mouth are borne the two tentacles. The branchiferous lobes are somewhat club-shaped, a little shorter than the head, and covered with branchiæ, about sixty on each. The two tentacles are cylindrical, longitudinally grooved bodies, which taper slightly towards the end, rather longer than the head, but scarcely a third of the diameter, devoid of papillæ.

The total length of the specimen, including the setæ, was 5 cm.; of the body excluding setæ and head-lobe, 2½ cm. The head lobe with the branchiæ was 1·2 cm. in length. The greatest breadth of the body was ·5 cm.; the breadth at the posterior end ·2 cm.

Specimen B (fig. 3).—The form of the body is approximately cylindrical, broadest near the anterior end and gradually tapering

backwards. There are forty-three segments, which are quite distinct behind, but in front are not to be distinguished but for the bundles of setæ. The latter are situated on slight transverse elevations; there are four slender dorsal setæ directed forward and three curved ventral setæ; the latter first appear on the fifth segment. The head-lobe is similar to that of specimen A, but its extremity with the tentacles and the branchiæ has been lost; it is separated into two parts by a distinct narrow annular groove. The large setæ surrounding the head are twelve in number.

The total length, inclusive of the setæ, is 1 decimetre; that of the long setæ 4 cm. The remnant of the head-lobe is 1 cm. in length.

II. Position and relations of Coppingeria.

There can be no doubt of the relationship of this remarkable Polychaet to the members of the family *Chloraemidae*, both in external features, and, as will subsequently be shown, in internal structure. But there can I think be little more doubt that it is sufficiently far removed from its nearest relative—*Stylarioides*—to require a distinct generic appellation. The anterior setæ constitute the most striking feature; but perhaps a more important characteristic is the bifid and produced branchial apparatus with its numerous branchial filaments. I propose, to call the new genus *Coppingeria** and the species *longisetosa*. The characteristic features of the genus may be thus summarised:—

Body not greatly elongated, swollen in front, composed of a moderate number of segments which are not distinct except in the posterior portion of the body. Parapodia not prominent,

* After my friend Dr. R. W. Coppinger, M.D., Fleet-Surgeon, R.N., surgeon of H.M.S. "Discovery," during the Arctic Expedition of 1875-6, and of H.M.S. "Alert" during her southern cruise. In the account which he published of the latter voyage Dr. Coppinger thus refers to the worm under consideration:—"Among the Annelids was one with long glassy opalescent bristles surrounding the oral aperture and projecting forwards to a distance of one and a half inches from the praestomium."—(Cruise of the "Alert," p. 187.)

with two sets of setæ, except in a few of the most anterior segments; setæ of both sets few in number; those of the dorsal set very fine, tapering; those of the ventral set stouter, curved at the ends. The setæ of the most anterior segments greatly prolonged, forming a complete circlet directed forwards. The præstomium with two pairs of eyes. Branchiæ numerous, cylindrical, borne on a pair of club-shaped prolongations of the præstomium. Tentacles very long, cylindrical, smooth, with a ventral longitudinal groove. Peristomium produced, capable of being retracted together with the præstomium (and the branchiæ?) within a sheath formed for it by the following segment. Papillæ very numerous, not arranged in rows, and equally developed on all sides of the body; some of those around the bases of the anterior large setæ extremely produced.

III.—Description of two species of Stylarioides*.

Stylarioides cinctus (Plate xxvi. fig. 4).

The total length (exclusive of the setæ) is 2·25 cm. The longest setæ of the anterior segments are nearly one centimetre in length. The greatest breadth of the body is 3 mm. The total number of segments is 48.

The præstomium (fig. 5) is produced forwards on the dorsal side into a curved lamina, on the anterior edge of which are situated the branchiæ. Of the latter there are ten, all cylindrical filaments, the central pair considerably longer than the others and not very much shorter than the tentacles: each branchia presents a pair of longitudinal crimson bands. The antennæ are dorso-ventrally compressed, transversely corrugated, with a deep longitudinal ventral groove, about the length of the first four segments.

The body is cylindrical, somewhat dilated in the anterior portion, narrowing suddenly behind the twentieth segment; the posterior, narrow part tapering posteriorly. In a second specimen the ten

* As defined by Grube.

most anterior segments are constricted. The surface is of a dull brown colour, without a distinct layer of mucus, encrusted on the dorsal surface for some little distance at the anterior end with firmly fixed and closely set sand-grains.* The papillæ are not very numerous or very prominent, scattered over the surface, with a tendency to the formation of irregular transverse rows; they are equally developed on the dorsal and on the ventral surface. On the elevations from which the elongated setæ of the two anterior segments spring, there are papillæ of a slightly greater length than those on the general surface of the body. Each papilla is situated on a little elevated area.

The segments are not very distinct in the anterior swollen part of the body, but are much more evident behind. The parapodia do not project from the surface. The setæ of the first two segments are 40-50 in number, slender, slightly curved inwards, directed forwards. On each of the other segments there are three or four very slender dorsal setæ and three stouter ventral setæ. The former are transversely striated, as is usual in this family; they are rather longer than the segments; the latter have a short terminal segment, which is unjointed, curved, and pointed, articulating with the elongated, transversely striated basal portion; the ventral setæ project more prominently from the surface in the anterior segments than in the posterior.

Specimens of this species, together with the following, were got with the dredge near Watson's Bay in Port Jackson. It belongs to that section of the genus to which Grube refers *S. parmatus*, Gr., *S. Cariboum*, Gr., and *S. cingulatus*, Gr., and to which also *S. capensis*, McIntosh, belongs—all these forms being characterised by the presence on the dorsal surface of the anterior part of the body of a space covered with closely cemented sand-grains. I cannot identify the Port Jackson species with any of these.

* A similar feature is described by Grube ["Annulata Semperiana," 'Mém. de l'Acad. Imp. des Sci. de St. Pétersbourg,' vii. série, t. xxv. (1878)] in his *Stylarioides parmatus* from the Philippines, and by McIntosh in *Trophonia capensis* (" Challenger " Reports, Annelida).

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STYLARIOIDES HORSTII, (Plate XXVI. figs. 6-8).

Both of the specimens of this species that are at my disposal are imperfect; the more complete of the two is 1·5 cm. in length. The longest setæ are 2·5 mm. in length. The greatest breadth is 3·5 mm. The number of segments is 39.

The head and branchial apparatus are retracted in both specimens, but, when dissected out, showed the following features:— The tentacles are of about the length of the first six segments of the body; their greatest breadth is about one-seventh of their length. They are deeply grooved longitudinally on the ventral side—the ridges bordering the groove being convoluted—and are very finely and closely corrugated transversely on the opposite side. The branchiæ, six (?) in number, are very long, cylindrical, and pigmented at the ends.

The body is cylindrical, of nearly uniform breadth as far as the 33rd segment, though rather narrower at the anterior end; narrowing suddenly behind the 33rd segment. There is no encrustation of sand-grains. The setæ of the first two segments, about a dozen in number on either side in each, are greatly prolonged; they do not form a ring, but are arranged in definite lateral bundles. They are exceedingly fine, and are divided by transverse lines into numerous joints; they are covered with stalked infusoria like the rest of the setæ. The setæ of the third segment, 4-5 in number, are more conspicuous than those of the rest of the body, and are about half the length of the second segment; there appear to be no ventral setæ on this segment. The remaining segments all have dorsal and ventral setæ, which are both longer than is usual in this genus. Of the dorsal setæ there are five to eight in each bundle, many-jointed, very slender, tapering,—their length nearly half the breadth of the body. The ventral setæ, of which there are 4-6—usually 5—in each fasciculus, are much thicker than the dorsal, unjointed, laterally compressed, often twisted, slightly hooked at the ends, much longer in the anterior segments than they are further back.

A remarkable feature is the arrangement of the papillæ. Those of the first two segments are elongated, especially round the bases of the fasciculi of setæ. On the dorsal surface of the body each papilla is elevated on a conical wart-like protuberance, while on the ventral surface these elevations are absent. They are more numerous than in the preceding species, smaller and with a tendency to form transverse rows only on the dorsal surface.

I am not quite clear as to the position of this species; but if Grube's definitions of the genera *Trophonia* and *Stylarioides* be followed, the retractile praestomium would place it in the latter genus. At the same time, the considerable development of the setæ behind the head brings it nearer the species of *Trophonia*. It has considerable resemblance to the European *T. plumosa*, Müller; but the tubercles on that species are described as being found all over the body instead of being confined to the dorsal surface.

IV.—Integument and papillæ.

In *Coppingeria* the cuticle, which is of considerable thickness over all parts except the branchiæ, is covered superficially with a layer of a granular-looking substance with included irregular particles, which is evidently the layer of mucus with entangled granules of foreign matter present in other members of this family. This layer, however, though represented in all parts except the præ- and peristomium, with the branchiæ and tentacles, is comparatively thin, being for the most part of about the same thickness as the cuticle. A similar layer of tough gelatinous matter has been noticed by all who have given attention to the structure of this family of Polychaeta. In *Siphonostomum* it is separable with a little trouble from the body of the worm; but in the present form, as in *Stylarioides*, it is firmly adherent, so as to appear as a definite layer of the integument.

In *Coppingeria* the cuticle has the appearance of consisting of a single layer. But in *Stylarioides cinctus* (Pl. xxvii. fig. 15) there are two, the more internal having many papillæ and ridges, which penetrate into the outer.

The epidermis (plate XXVII. fig. 15) is a very thin layer save in certain situations, only reaching a considerable development on the præstomium and part of the peristomium, the grooves of the tentacles and the branchial filaments. Beneath each of the papillæ the epidermis becomes modified as described below. It consists of flattened cells (fig. 16) of polygonal outline, the reticulated protoplasm of which presents smaller and larger vacuoles. The reticulated substance of neighbouring cells is separated by narrow uncolourable bands, which anastomose and present the appearance of a branching system of fine channels, which may be connected with the secretion of the mucus.

Like the adherent layer of mucus the *papillæ* are specially characteristic of the *Chloraemidae*, and appear to be present in one form or another in all the members of the family. They have been described under various names, "mucus-secreting papillæ," "poils," "tubercles," "granules." They attain their greatest development as regards length in *Siphonostomum*, where they are greatly elongated, so as to penetrate to the surface through the relatively very thick layer of mucus. In *Coppingeria* (plate XXVII. figs. 11-14) they occur over the entire surface of the body, giving it a very remarkable appearance when examined with a lens, owing to their resemblance to the tube-feet of a sporadipodous Holothurian. They are not of uniform length, but vary considerably in this respect, a fact which might be apt to produce the erroneous impression that they are extensile and retractile. They are specially developed around the bases of the cephalic setæ, where they attain a length of as much as 3 or 4 mm. In other parts they are much shorter, on an average ·5 mm. in length. Their form is subcylindrical, with a slight terminal knob-like enlargement; in the shorter forms there is usually a considerable amount of constriction at the base, and in these also the apex is pushed in to form a shallow cup-like concavity, which may, however, though very regular, have been produced, or at least increased, by the action of the alcohol.

The memoirs of Delle Chiaje not being at present accessible to me, the earliest detailed account of these papillæ which I have

met with is that of Dujardin. In his account of *Chloraema Edwardsii** he speaks of the sort of fleece or felt with which it is covered, composed of hollow flexible filaments, club-shaped at the extremity, and constituting a series of minute stalked glands secreting the mucus. Costa† in his account of *Siphonostoma diplochaitos* makes mention of the papillæ or stalked glands, as he regards them. Those of *Lophiocephalus* he describes as vascular and as having an aperture at the extremity for the discharge of the mucus.

Leuckart in his "Beitrage zur Kenntniss der Fauna von Island"‡ also describes the papillæ of *Siphonostomum vaginiferum* as appendages of the vascular system; but he contends that, though the extremity may present a pit-like depression, it is never perforated. He is inclined to favour Rathke's and Costa's view that they have to do with the secretion of the mucus, but suggests that they may also be concerned in the process of respiration.

Schmarda§ in his description of *Trophonia xanthotricha* mentions the presence in each segment of a transverse row of little suckers which when retracted appear like minute warts. These, he states, the animal uses to fasten itself, and also employs them in locomotion, like the tube-feet of the Echinoderms.

Quatrefages‖ gives the following account of these structures in *Chloraema Dujardini*:—"Les poils recouvrent le corps tout entier à l'exception de la face ventrale. Ils sont formés par une tige très grêle, qui se renfle brusquement à l'extremité. Ce renflement est ordinairement presque piriforme aux poils voisins des pieds et simplement arrondi sur le reste du corps. A l'intérieur, on distingue des cloisons cellulaires irrégulières, qui rappellent

* "Observations sur quelques Annélides marines." 'Ann. des Sci. Nat.' 2e série, tome XI. (1839), p. 289.

† "Description de quelques Annélides nouvelles du Golfe de Naples." 'Ann. des Sci. Nat.' 2e série, tome XVI., 1841.

‡ Archiv f. Naturg. XXIX. (1849).

§ Neue wirbellose Thiere.

‖ Histoire Naturelle des Annélés," tome I., p. 474 (1865).

celles de l'âme d'une plume . . . Partout ils sont noyés dans une mucosité parfaitement transparente." . . .

In his "Memoire sur la famille des Chlorèmiens,"* he had previously expressed the opinion that the granular contents, in the case at least of some of the papillæ, were continuous with the epidermis.

Claparède† gives the most complete account of the papillæ. In *Stylarioides monilifer* he states that their form appears usually cylindrical, but adds that that is due to the encrusting layer of mucus, on the removal of which the papilla appears in the form of a spherical button at the end of a pedicle. Both pedicle and button are formed of two layers, the more external of which is homogeneous and is a continuation of the cuticle, while the other, finely granular, is the subcuticular layer. He had not succeeded by means of any re-agent in discovering any nuclei in the granular layer. The same structures in *Trophonia eruca* he describes in similar terms.

In the case of *Siphonostoma diplochaïtos* the same author describes the peduncle of the papillæ as formed of a cuticular envelope and an axial granular layer with ill-defined longitudinal fibrillation. In this axial substance, numerous elliptical nuclei, having their long axes parallel with the axis of the peduncle, are brought into view under the action of acetic acid. The base of the club-like enlargement is filled with globular finely granular masses without cellular structure. Further on the central substance re-assumes its ill-defined fibrillar structure, and terminates in several pyriform bodies of a sulphur-yellow colour. He denies the asserted vascularity of the papillæ, and sets them down as without doubt tactile organs.

Grube‡ comes back to the view of Costa and Leuckart that the papillæ are concerned with the secretion of the layer of mucus.

* 'Ann. Sci. Nat.' 3e série, tome XII. (1849), p. 277.

† "Les Annélides Chétopodes du Golfe de Naples," p. 357 (1868).

‡ "Bemerkungen über die Familie der Chlorhaeminen." 'Bericht der Schles. Gesellsch.' 1876, p. 37.

Studer in his account of *Brada mammillata** describes the epithelium as consisting of narrow cylindrical cells, and gives an account of certain sac-like structures formed from groups of modified epithelial cells, which he regards as glands, leading by a duct to a pore on the summit of one of the tubercles. These so-called glands are the basal ganglia of the papillæ described below. Joyeux-Laffuie holds with Kolliker that there is every reason to regard the papillæ as tactile organs.

In most respects my own observations on this point agree with those of Claparède; and I have been able to add some details regarding the structure of the appendages in question which go to confirm his opinion of their function. In *Coppingeria* (figs. 11-14) all the papillæ have essentially the same structure. Most externally is a thick firm layer continuous with the cuticle of the general surface. Immediately below this is a thin layer continuous with the epithelium. These layers bound a cylindrical cavity, which is continued at the base into a narrow canal. Immediately below the base of each papilla is a little ganglion composed of a rounded group of cells with a mass of granular matter on its deeper face.† Delicate strands run outwards from this basal ganglion and, passing through the narrow neck of the papilla, enter a second ganglion in the base of the latter. From this there runs to the extremity of the papilla an axial strand of fibres with occasional nuclei, and from this run out a few similar but finer branch strands, which end in the epithelium. The axial strand breaks up at the end into a few delicate radiating fibres, which terminate in a group of cells, constituting what might be regarded as a third ganglion at the extremity of the papilla.

In view of their structure, there can be no doubt that these are sensory papillæ. They contain no muscular elements, and, therefore, can have nothing to do with locomotion or fixation. They contain no cells that can be construed as gland-cells, and therefore

* "Beitrage zur Naturgeschichte wirbelloser Thiere in Kerguelensland." 'Arch. f. Naturg.' 1878.

† The granular matter is not present in the case of the elongated papillæ at the anterior end of the body.

they cannot have specially to do with the secretion of mucus. Their structure is almost exactly similar in all essential particulars to that of the papillæ on the elytra of the *Polynoidae* (fig. 18), and I have no doubt that the function is the same in both cases.*

In *Stylarioides cinctus* the form of the papillæ (fig. 15) is similar to that of those of *Coppingeria*; but each papilla here is situated on the summit of a conical elevation, in which is contained the relatively large basal ganglion. In *Stylarioides Horstii* the papillæ (figs. 17*a* and 17*b*) are very long and slender, not unlike those of *Siphonostomum*, but with only a very faint terminal swelling. Each is covered, except at the extreme end, by a very thick layer of tough mucus. In *Stylarioides monilifer* (fig. 19) the form and structure of the papillæ is essentially similar to those of *S. cinctus*, the basal part being, however, relatively longer.

V.—Blood-vascular system; branchiæ; unpaired gland.

Considerable discrepancies exist between the descriptions of the vessels in the *Chloraemidae* given by different authors.

Dujardin† simply states that he had seen the green blood circulate in dorsal and ventral longitudinal vessels with numerous transverse branches.

Costa‡ describes the ventral vessel ("vaisseau abdominal ou veineux") in *Lophiocephalus* as not extending through the length of the body and not adhering to the body-wall, but as free, arising from the lower part of the œsophagus, increasing in size as it extends backwards, attaching itself to the walls of the stomach, again becoming reduced in size and losing itself in ramifications on that organ as well as on the wall of the body. From the ventral vessel it passes to the branchiæ, by which it returns through the dorsal vessel or heart, which in turn breaks up into

* *Vide* Jourdan, "Structure des élytres de quelques Polynoës," 'Zool. Anz.,' 8, p. 128.

† L.c. (8).

‡ L.c. (6).

branches on the stomach. In *Siphonostoma diplochaïtos* he describes the circulation as similar to that of *Lophiocephalus*, with the exception that both dorsal and ventral vessels have a dilatation situated much nearer the head.

Quatrefages* states that in *Chloraema Dujardinii* there are two dorsal trunks, which are united in front and behind in all the extent of the narrow part of the intestinal tube. But they become isolated and attain a more considerable size on arriving at the dilated portion possessing a layer of hepatic cells. Here each of them becomes cemented to one of the sides of the digestive tube, and they become united anew in the region of the œsophagus to form a thick fusiform contractile trunk, which drives the blood towards the branchiæ.

Claparède† describes the dorsal and ventral vessels in *Stylarioides* as both being simple, with lateral branches in each segment; the intestine is accompanied by two inferior enteric vessels situated close together. Grube‡ merely mentions the presence of dorsal and ventral vessels with transverse branches.

In his "Recherches sur le système vasculaire des Annélides"§ Jacquet describes at considerable length the vascular system in *Siphonostoma diplochaitos*. He alludes to the observations of Delle Chiaje, Costa, Quatrefages, and Claparède, already referred to, with regard more especially to their interpretation of the character of what he calls the dorsal vessel. Referring to the statement of Claparède that the structure in question is a gland which has been mistaken for a blood-vessel owing to its colour, he expresses the opinion that this soi-disant gland only differs from the ordinary blood vessels in its deeper colour, which is due to its larger size and the larger quantity of liquid which it contains as well as to the presence of pigmented elements in its walls.

* "Mémoire sur la famille des Chlorémiens," 'Ann. Sci. Nat.' 3e. série, t. xii. (1849).

† "Annélides Chétopodes du Golfe de Naples," p. 363.

‡ "Bemerkungen uber die Familie der Chloræminen," 'Bericht der Schles. Gesellsch.,' 1876, p. 39.

§ "Mittheil. a.d. zool. Stat. zu Neap.," vi. Bd. (1885), pp. 370-379.

His description begins with the branchial vessels. In each branchia there are two vessels, communicating with one another at the extremity of the filament. To the bases of the branchiæ the blood is carried by a canal coming from the neighbourhood of the end of the dorsal contractile trunk. This canal divides into branches for the branchial filaments (one to each), and also gives off a pair of branches to the tentacles.

The dorsal contractile trunk or heart, he states, is united directly with the ventral at a point below a pigmented spot which he regards as a visual organ. Further back it gives off various branches, the course of which is described. One of the two largest pairs of these is directed forwards; it is cemented to the inner surface of the skin in its dorsal part. The second pair, which is the larger, takes origin a little below the first and runs backwards; it is also cemented to the skin, and it terminates abruptly at the sixth pair of parapodia. Behind this there is no dorsal vessel proper. The heart terminates behind in the wall of the stomach in a system of sinuses, and Jacquet conjectures that the anterior dilated part may have a glandular wall secreting some digestive substance, which is carried to the stomach in the blood; the plexus of sinuses extends backwards in the wall of the intestine. A ventral vessel extends from one extremity of the body to the other. In the neighbourhood of the mouth it divides into two branches, which pass round the œsophagus to unite with the anterior end of the heart. He contrasts the arrangement described with that which is given by Quatrefages for *Chloraema*, and draws the inference that there is a considerable amount of difference in internal structure between the two genera.

There would thus appear to be a considerable amount of difference in the arrangement of the vessels in the various genera. As far as my own observations on this subject extend, the following would appear to be the *general* features of the vascular system in this family. There is a peri-intestinal sinus or plexus of sinuses in the wall of the alimentary canal. This terminates in front at the cardiac end of the stomach, and from it runs forwards a large median dorsal vessel or heart, which is subject

to regular peristaltic contractions, driving the blood from behind forwards. This vessel contains the unpaired cardiac gland, to which reference is made below. In the peristomial region it divides into two main afferent branchial vessels, each of which divides to give rise to the corresponding tentacular and branchial branches.

In *Coppingeria* the arrangement of the vessels conforms in all essential respects to that described by Claparède for *Stylarioides (Trophonia) monilifer*. There is a peri-intestinal sinus or rather plexus of sinuses in the wall of the stomach. From this, at the anterior end of the stomach, passes forwards the short dorsal vessel or heart, almost parallel with and on the dorsal side of the œsophagus. This bifurcates in the anterior part of the peristomium. Each branch enters the branchial stalk and breaks up anteriorly into a number of afferent branchial vessels (fig. 25, *br.*), each running to the end of one of the branchiæ. The blood returning from the extremities of the branchiæ by means of the efferent branchial vessels must be carried back by a trunk, which appears in my sections as a vessel of small size, running backwards just above the œsophagus. This bifurcates behind, the two branches thus formed embracing the œsophagus at its posterior end and uniting below with the ventral vessel. The latter runs forwards only a short distance in front of this junction, but is continued backwards throughout the body. On the dorsal side there is given off from the heart a dorsal vessel which runs backwards throughout the length of the body on the dorsal aspect above the alimentary canal.

Claparède (l c., p. 360) describes the branchial vessels in *Stylarioides monilifer* as having lateral diverticula ("anses"), and in his figure of a portion of a branchia (plate xxv., 1B.) transverse dotted bands are described as the diverticula in question, covered with brown pigment. There are no lateral diverticula in *Coppingeria* nor in *Stylarioides cinctus*. The branchial vessels in the former are accompanied by bands of a granular material which colours deeply with haematoxylin and which may contain pigment; in the latter there is a reddish-brown pigment. These pigmented

elements remind one of the structures called "pigmented lymph-glands" by Eduard Meyer,* found on the branchial vessels of *Terebellidae* and *Cirratulidae*, and probably are of a similar character.

The epithelium covering the branchiæ is peculiarly modified in *Coppingeria*, the cells as seen in sections having straight sharply-defined lateral borders, as if they had acquired a stiff and rigid character; as there is no internal supporting layer, it is likely that this is actually the case, and that the ciliated epithelium acts to some extent as a supporting structure.

Considerable confusion has existed regarding the relations of an unpaired gland situated in the dorsal region of the anterior part of the body; it has been noticed and described by various observers, but by nearly all its position has been incorrectly interpreted.

The structure in question seems to be represented in Costa's figures, though it is neither referred to in the text nor in the explanation of the plates. It does not seem to have been noticed by Dujardin, by Quatrefages, or by Leuckart.

Claparède† states that it had been observed by Delle Chiaje in *Stylarioides* and regarded by him as a cœcum of the alimentary canal. Claparède describes it as a cœcal tube of an intense black colour, sometimes inclined to green, extending backwards as far as the stomach, to which it adheres by its blind posterior extremity. It appears to open in front on the dorsal wall of the buccal cavity. It is formed of two layers—an outer, very thick, colourless, muscular, and rich in vascular plexuses, the inner, an epithelium of intense blackness—the cells being loaded with dark granules. The functions of the gland he looks upon as entirely problematical.

In his account of *Siphonostoma diplochaïtos* the same author remarks (p. 370) that Max Müller, following Costa, had fallen into a grave error in describing this structure as a large blind vessel.

* "Studien über den Korperbau der Anneliden." 'Mittheil. a. d. Zool. Stat. zu Neapel,' vii., p. 645 (1887).

† L.c., p. 362.

Grube follows Claparède in his view of the structure in question.

Langerhans* describes in *Brada inhabilis* three glands as opening in the neighbourhood of the mouth, a median one, the cells of which contain brown pigment granules, and a pair, in the cells of which are round concretions.

Studer† describes the unpaired gland as opening in front over the œsophagus.

Jacquet comments (l.c., p. 373) on the numerous misconceptions to which the dorsal vessel has given rise, and, after quoting the opinion of Claparède, to which reference is made above, goes on to say:—"Nous verrons que Claparède en voulant relever une donnée qu'il considerait comme erronee, retombe dans les idées de quelquesuns de ses prédécesseurs, idées que je suis arrivé à considerer comme fausses. Cet auteur croit avoir trouvé la cause, qui a induit en erreur Costa, dans la couleur de cette glande. Si cette soi-disant glande est plus foncée qu'un vaisseau sanguin ordinaire, cela depend de deux motifs. Comme cet organe présente dans sa partie la plus renflée un diametre de plus de vingt fois celui d'un canal sanguin, il est naturel que contenant une beaucoup plus grand quantité de liquide, celui-ci paraîtra plus foncé. En outre, on remarque que les parois de cet organe contiennent des éléments pigmentés." Further on he conjectures that the anterior dilated part of the dorsal vessel may have a glandular wall secreting a substance calculated to facilitate digestion. He thus denies entirely the presence of anything but a thick dorsal vessel or heart with a pigmented and perhaps glandular wall.

Horst‡ was the first, so far as I have been able to determine, who gave an accurate account of this structure. He shows that it is the dorsal vessel *enclosing in its interior* an elongated narrow

* "Die Wurmfauna von Madeira," 'Zeitschr. f. wiss. Zool.' xxxiv. Band. (1880).

† "Beitrage zur Naturgeschichte wirbelloser Thiere in Kerguelensland" 'Archiv fur Naturgesch.' 1878.

‡ "Ueber ein rathselhaftes Organ bei den Chloræmiden," 'Zool. Anz.' viii. (1885).

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dark body, which is continuous behind with the wall of the stomach. This peculiar dark body is composed of different strands irregularly entwined and mostly with an oval transverse section, formed of cells filled with brown granules, the cell-structure not being always distinctly visible. He does not definitely suggest any function for the dark glandular body, but points out that it has its homologues in various sedentary Annelids—such as *Terebella* and *Cirratulus*—as well as in *Polyophthalmus*, *Ctenodrilus*, and *Enchytraeus*.

Cunningham* states that in *Trophonia plumosa* the somewhat cylindrical cords, of which the cardiac body is made up, are seen in sections not to be composed entirely of cells, but in most cases to possess a lumen, the cells around which form a glandular-looking epithelium of several layers—the more internal clear and vacuolated. He finds no trace of any opening either in front or behind. In *Flabelligera affinis (Siphonostoma)* the organ in question is very different; it is relatively narrow and occupies only a small part of the lumen of the heart; it has the form of a narrow irregular flat band, which in transverse section appears as an irregularly branching narrow tract without distinct lumen, the walls being in close contact. The clear vacuolated cells are absent—the epithelium consisting entirely of elongated columnar nucleated cells; and the granules are smaller and less numerous. Cunningham dissents from Horst's view that the organ in *Enchytraeus* is homologous with the cardiac body of the *Chloraemidae*. He states that in *Trophonia* there is no connection between the cardiac body and the intestinal epithelium.

In *Coppingeria*, *Stylarioides cinctus*, and *S. Horstii*, and *Siphonostomum affine*, this cardiac body is a greatly-elongated dark-coloured structure, which lies in the interior of the heart or contractile dorsal vessel. In front it is very narrow (fig. 20 *c. b.*) and does not nearly fill up the lumen of the vessel; but further back it is broader, and in sections appears completely to block up the cavity.

* "Some points in the Anatomy of the Polychæta," 'Quart. Journ. Micro. Sci.' vol. XXVIII.

In a living specimen of *Siphonostomum affine*, however, it was seen that the vessel in a dilated state is considerably larger than the enclosed cardiac body. The latter consists of longitudinally arranged lobes, which in all the specimens examined had lost their cellular structure,—this being represented in the case of *Coppingeria* merely by nuclei and faint traces of cell-bodies. An examination of my sections confirms Cunningham's statement that there is no connection whatever between the cardiac body and the intestinal epithelium. In front it is continuous with the wall of the vessel; behind it is completely free and moves passively with the peristaltic contractions Cunningham describes a lumen as being present in the cardiac body, but in this I think he is mistaken. The lobes are in some parts slightly separated from one another, leaving fissures here and there, sometimes there is a star-shaped fissure in the middle, but where this is the case the space is filled with blood. Whatever may be their condition at an earlier stage, the lobes in the specimens I have examined are solid and contain no lumen.

VI. Alimentary canal and nephridia.

The special features of the alimentary canal in this family have been described by various authors, and I have little to add with regard to *Coppingeria* to what has been already published. The anterior part is in the form of a narrow œsophagus, with a high epithelium of ciliated cells. The wide stomach, with its anteriorly projecting cæcum, is thin-walled, with a low epithelial lining; it is filled with particles of mud containing the remains of many microscopic organisms. The narrow intestine has a comparatively thick wall, with an epithelial layer of elongated ciliated cells; its lumen contains no food particles. The peculiar orange colour of the stomach in its anterior portion, which appears to be general in this family, is, of course, not to be detected in a specimen so long preserved in spirits, but is well-marked in *Stylarioides cinctus*. In this species the hinder part of the stomach (fig. 21) is bent on itself so as to run obliquely forwards for a little distance before passing into the intestine; the latter is bent round in the way

represented in the figure, before pursuing its straight course backwards towards the anus.

The nephridia were described by Otto as salivary glands, and the same view of their nature was taken by Quatrefages* as well as by Dujardin. They are only very obscurely referred to by Costa.

Leuckart (l.c., p. 166) expresses a doubt as to the correctness of Rathke's view that these represent salivary glands, and suggests that they may be comparable to the Polian vesicles of Echinoderms.

Claparède, to whom we owe the earliest recognition of the true nature of these bodies, states† that they had been seen by Delle Chiaje and Rathke as well as Kölliker. He remarks that there is a great resemblance, as had already been pointed out by the last-named observer, between these organs and the renal organs of the Gasteropoda. He describes them in *Stylarioides* as tubular glands opening externally near the mouth and terminating behind in a cul-de-sac at the sides of the stomach, in the eighth segment. They are full of spherical bodies resembling cells, but without evident nuclei, and each of them containing a single spherical concretion or several.

Grube's statement regarding these bodies is essentially a repetition of Claparède's.

Langerhans,‡ as already mentioned, describes three glands as opening in the neighbourhood of the mouth in *Brada inhabilis*, Rathke, the unpaired one being evidently the cardiac body and the lateral, containing round concretions, the nephridia.

Studer describes these excretory glands as opening in front into the anterior part of the pharynx.

In *Coppingeria* these glands are of large size and deeply lobed. They extend from the posterior part of the praestomium backwards through the following two or three segments, and are prolonged

* "Mémoire sur la famille des Chlorémiens." 'Ann. Sci. Nat.' 2e série, tome XII. (1849), p. 277.

† L.c., p. 362.

‡ "Die Wurmfauna von Madeira," 'Zeitsch. f. wiss. Zool.' XXXIV. (1880).

for some distance further back in the form of two comparatively narrow tubes, which lie close together on either side of the middle line of the dorsal part of the body-cavity. Their ducts meet in front below the œsophagus, and the median duct thus formed appears to open on the ventral aspect of the praestomium, but defects in the sections leave this doubtful. The glands are lined with an epithelium of large irregularly-shaped cells (fig. 22) with vacuolated protoplasm containing numerous rounded granules of various sizes, some of which are stained darkly by haematoxylin, the largest having the appearance of being made up by the coalescence of numerous extremely minute particles.

In *Stylarioides cinctus* these glands are in the form of narrow twisted tubes, the cells lining which are similar to those just described. The granules do not become stained by borax carmine and a nucleus becomes revealed in each cell. In *Siphonostomum affine* the cells have the form represented in figure 23, mostly narrow at the base, with a rounded bulging at the free extremity, containing numerous minute granules scattered through their protoplasm and some larger ones at the base, where there is in most a zone of protoplasm which stains more deeply with haematoxylin than the rest.

VII. Nervous system, eyes, and tentacles.

The remarkable position occupied by the ventral nerve-chain in the members of this family was remarked upon by Leuckart in his account of *Siphonostomum vaginiferum*, Rathke (l.c., p. 165). It is completely separated from the epidermis, and lies within the layer of circular and oblique muscular fibres of the body wall. The cord presents very distinct ganglionic swellings, which are bilobed externally, though completely fused internally; between the ganglia the cord is distinctly double. The œsophageal commissures are of great length in co-ordination with the retractility of the prae- and peristomia. The anterior part of the nerve cord in *Stylarioides cinctus* is represented in plate XXVIII, fig. 24.

The presence of eyes in members of this family has frequently been overlooked owing to the retractile character of the praesto-

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mium on which they are situated. Quatrefages describes *Chloraema Dujardinii* as possessing a single pair of eyes placed close together. Leuckart describes two pairs of eyes in *Siphonostomum vaginiferum*, and Johnston[*] states that *Siphonostomum uncinatum* possesses four eyes. This is confirmed by Jourdan[†] as regards *S. diplochaïtos*, and by Joyeux-Laffuie[‡] as regards *Chloraema Dujardinii*. I have observed the same to hold good in regard to *Siphonostomum affine*, *Stylarioides cinctus*, *S. Horstii*, and *Coppingeria longisetosa*. It seems probable in fact that the presence of four eyes is general in this family.

The two pairs of eyes in *Coppingeria* (fig. 26) are situated on a lobe, which is a process from the præstomium between the bases of the branchiæ. Into the interior of the oculiferous lobe projects a group of nerve-cells, forming an optic ganglion, which is really a lobe of the brain, with which it is in immediate connection—the optic nerves mentioned by Quatrefages[§] not being represented. Both eyes project prominently on the surface, those of the anterior pair being the larger. The cuticle forms a concavo-convex thickening (*cu.*) over the eye, immediately internal to which is a layer of cells (*c*), which present no regular arrangement. Then follows a layer of thick crystalline rods (*r*), which are probably continuous with elements composing a cup-shaped layer of darkly pigmented substance (*pi.*), outside of which are the nerve-cells. In *Siphonostomum affine* and *Stylarioides cinctus* the eyes are less prominent, and are buried in the substance of the præstomial lobe.

In *Siphonostomum affine* (fig. 27) they differ slightly from those of *Coppingeria*. The pigment (*pi.*) forms an almost complete capsule, with only a small opening. Enclosed within this are a series of thick rods, which fill up the whole of the cavity—there being no nucleated elements in the interior of the pigment capsule.

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* "Catalogue of British Non-Parasitical Worms."

† "Etude anatomique sur le Siphonostoma diplochaïtos, Otto." 'Ann. Mus. d'Hist. Nat. Marseille,' Zool. t. 3, Mem. No. 2. This is known to me only through the abstract in the "Zool. Jahresb." (1887, Vermes, p. 64).

‡ "Sur l'organisation des Chlorèmiens." 'Compt. Rend.' t. 104, p. 1377.

§ "Hist. Nat. des Annélés," tome I., p. 471.

There is a sort of cornea-lens, however, formed of a number of elongated epidermal cells, which pass over the outer side of the eye.

The *tentacles* in *Coppingeria* are slightly corrugated transversely, and are marked by a deep longitudinal groove on the ventral surface. They are hollow, and the cavity is divided by a dorso-ventral longitudinal septum. In the septum runs the main blood-vessel. The wall of the tentacle contains a thin circular or oblique and a much thicker longitudinal layer of muscular fibres. The cuticle is very thin; the epidermis has the cells more elongated than in the body; here and there is a cell which stains more strongly than the others, of a spindle-like shape, perhaps a sensory cell. The epithelium (fig. 28) on the inner faces of the ridges bounding the ventral groove is specially modified. Many, or all, of the cells are provided with close-set short cilia. They are very long and narrow—many almost fibre-like,—and from their inner ends pass delicate fibres to a nerve situated (*n*) at the base of the ridge. We have here evidently an epithelium which is specialised not only in the direction of bearing cilia for driving food towards the mouth, but also in that of possessing numerous sensory cells, connected either with a specially developed tactile sense or with a sense of taste or smell.

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EXPLANATION OF PLATES.

PLATE XXVI.

Fig. 1.—Port Molle specimen of *Coppingeria longisetosa*, three times the natural size.

Fig. 2.—Produced peristomium and præstomium with tentacles and branchiæ seen from the dorsal aspect: *br.*, branchiæ; *te.*, tentacle.

Fig. 3.—Darnley Island specimen, thrice the natural size; lateral view.

Fig. 4.—*Stylarioides cinctus*, magnified.

Fig. 5.—Anterior extremity of the same with the tentacles and branchiæ; ventral view: *br.*, branchiæ; *te.*, tentacles.

Fig. 6.—Anterior end of *Stylarioides Horstii*, from the dorsal side; magnified.

Fig. 7.—The same, from the side.

Fig. 8.—Ventral view of the same.

Plate XXVII.

Fig. 9.—Ventral seta of *Coppingeria longisetosa*. × 100.

Fig. 10.—Ventral seta of *Stylarioides cinctus*.

Fig. 11.—Section of one of the shorter papillæ of *Coppingeria*.

Fig. 12.—Section through one of the longer papillæ of the same: *m.*, mucus; g^2., g^3., ganglia.

Fig. 13.—A papilla of the same with the extremity inverted: *m.*, mucus; g^2., g^3., ganglia.

Fig. 14.—Papilla of the same showing the basal ganglion, g^1.; *cu.*, cuticle; *mu.*, outer muscular layers of body wall.

Fig. 15.—Section of the integument of *Stylarioides cinctus*: *g.*, basal ganglia; *m.*, layer of mucus; *c′.*, external, and *c″.*, internal layers of cuticle; *e.*, epidermis; *mu.*, muscular layer.

Fig. 16.—Surface view of epidermal cells of *Stylarioides cinctus*.

Figs. 17a and 17b.—Papilla of *Stylarioides Horstii*.

Fig. 18.—From section of an elytron of a species of *Polynoe*, showing sensory papilla: *n.*, nerve branch; *g.*, ganglion.

Fig. 19.—Papilla of *Stylarioides monilifer*: *g.*, basal ganglion; *m.*, mucus.

Fig. 20.—Transverse section of the anterior part of the body of *Coppingeria longisetosa* to show the position of the cardiac body: *h.*, "heart;" *cb.*, cardiac body; *vv.*, ventral vessel; *œs.*, œsophagus; *lm.*, longitudinal bundles of muscular fibres.

Fig. 21.—Stomach, with œsophagus and beginning of intestine of *Stylarioides cinctus*.

Fig. 22.—Part of a section through one of the nephridia of *Coppingeria longisetosa*.

Fig. 23.—Part of a section through nephridium of *Siphonostomum affine*.

Plate XXVIII.

Fig. 24.—Anterior part of ventral chain of ganglia in *Stylarioides cinctus*: *c.*, commissures connecting cerebral and first ventral ganglia.

Fig. 25.—Section (nearly transverse) through the præstomium of *Coppingeria* in the region of the cerebral ganglion (*g*): *dv.*, two main branches of the dorsal vessel; *br.*, afferent branchial vessels; *pt.*, pigmented (?) cords accompanying branchial vessels; *tv.*, tentacular vessel; *m.*, mouth.

Fig. 26.—Section of eye of *Coppingeria*: *cu.*, cuticle with its thickening over the eye; *e.*, layer of modified epidermal cells; *r.*, crystalline rods; *pc.*, pigment cup; *g.*, nerve-cells.

Fig. 27.—Section of eye of *Siphonostomum affine*: *co.*, cornea lens; *pi.*, pigment cup; *r.*, crystalline body.

Fig. 28.—Lateral and ventral part of a transverse section through a tentacle of *Coppingeria*: *gr.*, ventral ciliated groove; *n.*, nerve.

NOTES ON AUSTRALIAN ABORIGINAL STONE WEAPONS AND IMPLEMENTS.

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(Plates xxix.-xxxvi.)

xvi.—*Tomahawks and Axes.*

It was explained in my last Paper*, communicated to this Society on February 25th last, that for an opportunity of describing the present fine series of stone tomahawks and axes, thanks are primarily due to Sir W. Macleay, Mr. C. W. De Vis, Dr. J. C. Cox, and others to be severally mentioned under their respective specimens.

In such descriptions much difficulty is experienced from the want of some satisfactory method of classification, whether it be from the point of view of their physical characters, mode of preparation, or apparent use by those who employed them in their daily avocations. At present, no such classification exists, so far as I know, nor do I at present feel prepared to propose a permanent one. The difficulties attending this will be touched on more at length on another occasion. No doubt the most convenient place to attempt some such classification would be an extensive museum collection, any series formed by a private collector being of too limited a nature for the object under consideration. With the view, however, of simplifying the descriptions which follow, I have tentatively grouped the implements under the succeeding three groups, and two other subsidiary sections, divisible into various types.

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* Abst. Proc. Linn. Soc. N. S. Wales, February 25th, 1891, p. iii.

Group I.—TOMAHAWKS.

Section A.—*Without a hafting groove.*

1. Oblong-ovate type.
2. Ovate type.
3. Deltoid, or subtriangular type.
4. Gad-shaped type.
5. Chisel-shaped type.

Section B.—*With a hafting groove.*

1. Ovate type.

Group II.—HAFTED AXES.

Group III.—HAND-AXES AND WEDGES.

In the succeeding descriptions the following terminology has been made use of:—The *lateral surfaces* are the more or less broad sides of the tomahawk, the *cutting edge* the generally curved sharp edge, produced by grinding the lateral surfaces, the portion of the latter ground at the anterior end is the *bevel;* the opposite end to the cutting edge, or posterior end, is the *butt*, the secondary surfaces, caused by striking off flakes, and usually conchoidal, are the *facets.*

I.—TOMAHAWKS.

Section A.—*Without a hafting groove.*

I opine that this section will comprise by far the largest number of aboriginal stone implements commonly known under the name of "tomahawks," excepting perhaps those of Western Australia, which will require separating as a distinct group.

1. *Oblong-ovate Type.* Of this form an excellent example has been lent for examination by Mr. Herbert Lowe, of Gooree, Mudgee, unchipped, and partially polished. It is composed of a very dark green hornblende and epidote rock*, and was originally an oblong, narrow pebble, with a highly roughened surface, arising from attrition. The broader end has been ground to a

* I am indebted to Prof. T. W. E. David for assistance in determining the petrological characters of the various specimens, but from macroscopical inspection only.

sharp cutting edge, the bevel smoothed off and polished. The cutting edge is sharp, and fairly equal in its curvature.

The following are the measurements of this tomahawk:—Length, $5\frac{1}{4}$in.; breadth, $2\frac{1}{2}$in.; thickness, $1\frac{3}{4}$in.; weight, 1lb. 1oz.

Similar to Mr. Lowe's tomahawk are two from Braidwood, New South Wales, for which I am indebted to Mr. J. W. Penney, of Braidwood, forwarded through Mr. C. Roberts, J.P., of Boro. Both, originally pebbles, have been reduced in bulk by chipping, one much more so than the other. The least chipped (Pl. XXIX., figs. 1 and 2) is composed of very hard greenish diorite, probably containing a little free quartz, and has been thinned-off at both ends, leaving the centre the thickest part. The anterior end has been sufficiently ground to produce a sharp and very symmetrical cutting edge, and a flat bevel. This implement measures:—Length, $5\frac{1}{4}$in.; breadth, $2\frac{3}{4}$in.; thickness, $1\frac{3}{8}$in.; weight, 14oz.

The amount of chipping is not great, the working being confined to a few large facets near the butt. The second Braidwood specimen, on the other hand, is highly facetted by chipping, the rock of which it is composed, a greenish-black dioritic aphanite, lending itself to the process admirably, with a strongly marked conchoidal fracture. The cutting edge is remarkably true, and like the bevel, well executed, with the polished surface, which is exceedingly smooth and glossy, continued backwards for quite half the length of the implement; the gently convex surface is quite equal on both sides. The measurements are:—Length, $4\frac{3}{4}$in.; breadth, $2\frac{1}{2}$in.; thickness, $1\frac{5}{8}$in.; weight, 13oz.

Another illustration of this group is the well executed tomahawk already described in our "Proceedings,"* from Brisbane Water, near Gosford, composed of a dense, greenish-black, fragmental, basic rock, forming a very compact and neat implement.

The next specimen of this type is from Sir. W. Macleay's Collection, and although larger, is not so truly or excellently made.

* Proc. Linn. Soc. N. S. Wales, 1890, v. (2), Pt. 2, p. 292.

It is composed of a dark green greywacke, perhaps an altered mudstone, and has been formed from an unchipped elongated-oval pebble by grinding one side flat, and partially so the other. By this means the bevel of the cutting edge has been reduced to a minimum, and to a low angle not often met with in our aboriginal tomahawks, whilst the cutting edge is very obliquely rounded, protruding at what was probably the lower anterior corner. The surface, where not smoothed, is much pitted and worn. The measurements are:—Length, 5½in.; breadth, 3¼in.; thickness, 1⅝in.; weight, 1lb. 4oz.

An excellent example of the flaked form in this type is afforded by a tomahawk from New England, presented by Mr. H. W. Blomfield (Pl. XXIX., figs. 3 and 4). The original size of the stone has been entirely reduced by chipping, leaving a rude and uneven anterior end, partially bevelled off by friction. In its present condition the cutting edge is rough and broken. The facets do not show that marked diminution forwards, usually seen in aboriginal tomahawks, but on one side are as large at the anterior end as at the butt. The stone of which this implement is composed is a silicified claystone allied to lydianstone. The measurements are:—Length, 4½in.; breadth, 2⅝in.; thickness, 1⅜in.; weight, 10½oz.

Appertaining to this group are two small tomahawks presented to the Mining and Geological Museum by the Rev. J. Milne Curran, from the Macquarie River, but beyond their rather diminutive size they are not remarkable. Both are converted pebbles, one (*a*) simply by friction, the other (*b*) by chipping and friction. The former (*a*) is composed of a greenish black aphanitic diorite, and is slightly triangular in shape, increasing in breadth from the butt forwards. The cutting edge and bevel are both good, the former being straighter and less curved than usual.

In the second of these diminutive tools (*b*) the stone is a greenish-black diorite, speckled with small aggregates of triclinic felspar. The cutting edge is less true, having what my colleague, Mr. W. Anderson, has termed "a curvature in the line of its

greatest width."* The bevel is the only portion polished, the remainder showing strong traces of either fracture or chipping. Measurements:—(*a*) Length, 3⅜in.; breadth, 2in.; thickness, 1⅛in.; weight, 6oz. (*b*) Length, 3½in.; breadth, 2⅛in.; thickness, 1⅜in.; weight, 6oz.

As a last representative of this group may be mentioned a tomahawk of a dark green indurated diabasic tuff in the Mining and Geological Museum, from Dilga West, of an elongately oval shape. It has been a pebble, much weather-worn on the surface, and was evidently selected by its owner on account of the appropriate shape of the pebble, the only reduction it has undergone being a little chipping at the butt, which is square ended. The cutting edge is limited, and the bevel angle low. The measurements of this stone are:—Length, 4⅞in.; breadth, 2⅝in.; thickness, 1⅛in.; weight, 2lb. 1oz.

2. *Ovate Type.* By this form I intend to convey the impression of a tomahawk, less elongated transversely than in Type 1, and wider in proportion in a contrary direction, but still too long to be absolutely oval. Such implements are also usually larger. No better example of this form can be taken than one in Sir W. Macleay's Collection, formerly exhibited by Mr. J. G. Griffin,† and said to have been dredged from the Hawkesbury River. It is a pebble of diabasic dolerite, quite untouched with the exception of the ground bevelled edge, the remainder of the surface being smooth and unpolished. The bevelled edge does not show the same amount of finish as many other implements of a similar nature, as the scratches arising from the process of grinding still remain, and have not been removed by the after process of polishing which many aboriginal tomahawks certainly have undergone. The scratches in question show that the friction employed to produce the bevelled edge was not confined to one direction, for some of the striæ are in that of the longer axis, others in that of the shorter, and a third set have an oblique

* Records Geol. Survey N. S. Wales, 1890, ii., Pt. 2, p. 74.
† Proc. Linn. Soc. N. S. Wales, 1884, viii., p. 442.

direction. The measurements of this implement are:—Length, $5\frac{1}{2}$in.; breadth, $3\frac{7}{8}$in.; thickness, 2in.; weight, 1lb. 1oz.

Of a similar type, but both partially polished and chipped, is another tomahawk from the same collection, of a reddish hue, and composed of a felspathic quartzite (Pl. xxx., figs. 1 and 2). Like the preceding, it also appears to have been a pebble, of which the end selected to serve as the butt has been much flaked off, a process to which the stone seems to have readily yielded. The anterior, or fore end, has a long and well executed bevel, the curve of the cutting edge being one of the most perfect I have yet seen on a tomahawk of this description. If an imaginary line be drawn across the centre of the tomahawk, in the direction of its longer axis, the curve of the cutting edge will be found to be almost equilateral. Although the bevelled surface bears an excellent polish, the friction striæ still remain, and are chiefly transverse in their direction. The flakes at the butt have also been chipped in a similar line, and to such an extent as to render the anterior end the thicker by far. The measurements are:—Length, $4\frac{7}{8}$in.; breadth, $3\frac{3}{8}$in.; thickness, $1\frac{3}{8}$in.; weight, 14oz.

A somewhat heavier, larger, and longer weapon, but of this type, is before me from the Queensland Museum. It is composed of a hornblende schist, extensively flaked at the posterior end, and partially polished anteriorly. The locality is Fraser's Island, (? Hervey Bay). It would appear to have been a pebble, reduced at the butt by percussion, and laterally ground to some extent. The bevel is rather a high one, and the cutting edge again shows an irregularity of curvature, tending much towards one side. This is not a shapely or well finished implement, but is heavy and formidable. The measurements are:—Length, $5\frac{1}{2}$in.; breadth, $3\frac{1}{2}$in.; thickness, $1\frac{7}{8}$in., weight, $1\frac{3}{4}$lb.

A smaller and much ruder tomahawk is from the same locality and contained in the same collection. It is composed of a similar rock, and has been prepared in a like manner, but the cutting edge is much broken.

Another Queensland example of this series, and a rather peculiar one, is from Bulloo, Mogul Creek, Bulloo River,

Thargomindah, presented to the Mining and Geological Museum by Mr. H. A. Maclean. It clearly belongs to this type, but has been much reduced by the violent usage to which the butt has been subjected, breaking off large conchoidal and irregular pieces until hardly more than the bevelled sides are left. The latter, however, are very fine, long, quite smooth, well polished, and unequally convex. The cutting edge is broad and symmetrical. Measurements in this case are unnecessary. The rock is a dark green chloritic quartzite showing faint lines of lamination.

3. *Deltoid, or subtriangular Type.* This is perhaps one of the less common forms of stone tomahawk, the specimens exhibited, three in number, being certainly peculiar in shape. The first is from Normanton (Pl. xxx., figs. 3 and 4), again communicated, like so many of these fine implements, by Mr. C. W. De Vis, from the Queensland Museum Collection. It is a remarkably short and broad tomahawk, oval-deltoid in shape, originally a flattened pebble of dark green diabase or hypersthene gabbro. The butt has been chipped, but the remainder of the surface is quite smooth and glazed. The broader end has been ground on both sides to a cutting edge possessing a wide circular sweep, moderately symmetrical in its curvature. The measurements are:—Length, $3\frac{1}{4}$in.; breadth, $3\frac{1}{2}$in.; thickness, $1\frac{4}{8}$in.; weight, 11 oz.

Supposing this weapon to be hafted it would not, by any means, be unlike some of the small single-handed battle axes used by the knights of old. Of a similar type to the present is, I believe, the tomahawk figured by Smyth from the Munara district,* composed of a highly polished aphanite. It is much larger, however, than our example, and weighed two pounds four and a-half ounces. It is, of course, possible that this implement may appertain to the next general group, which I have termed "axes" in contradistinction to "tomahawks," but its resemblance in shape to the Normanton tomahawk has induced me to refer to it here.

The second of these deltoid implements is from the Macquarie River, by the Rev. J. Milne Curran. It is an obtuse sub-deltoid

* Aborigines of Victoria, 1878, i., p. 368, f. 181.

piece of rock produced by chipping and friction, with the butt end squared off, or hammer-head shaped. The bevelled faces are longer than in the first example of this type, and the cutting edge but little curved. It is composed of a dark green diorite with triclinic felspar, macroscopically developed in an aphanitic base, and is heavy for its small size. Its measurements are :—Length, 2⅝in. ; breadth, 2⅝in. ; thickness, 1⅛in. ; weight, 8oz

The third tomahawk of this series is equally peculiar with either of the others, if not more so, from its very short and broad proportions, the high angle of the bevelled faces, and particularly straight cutting edge. It seems to have been made out of a rough haphazard piece of grey diorite (triclinic felspar and hornblende) very much weathered, certainly not from a pebble. As sometimes happens in these implements, one face is longer than the other, and thus destroying the bilateral symmetry of the tomahawk. The cutting edge is straight and long. The measurements are :—Length, 2¾in. ; breadth, 2⅝in. ; thickness, 1⅜in. ; weight, 10oz.

4. *Gad shaped Type* This is a very interesting and well marked section, and does not seem to have been much noticed by authors. The form is always long, the transverse always greatly exceeding the longitudinal diameter, the section almost always more or less rounded, sometimes slightly flattened at the sides, and very rarely quadrangular.

Two examples of this form are lent by Sir W. Macleay, but beyond the fact that they are New South Welsh, no further history is known. Both have been pebbles One, of greenish syenitic granite, is square-headed at the butt, whilst the original rotundity of the pebble has not in any way been interfered with. The anterior end is very narrow, remarkably so for an aboriginal tomahawk, and in consequence the cutting edge is much reduced, and the curvature very slight. The other example is composed of a fine-grained dark green diorite, and has had the natural rotundity of the pebble reduced by friction, producing flattened sides, and the butt is obtusely pointed. The cutting edge is broader than

in the last specimen, though by no means greatly curved, whilst the bevel is at a very low angle. The measurements are:— Granite: Length, 5in.; breadth, 2in.; thickness, $1\frac{7}{8}$in.; weight, 1lb. Diorite: Length, $5\frac{7}{8}$in.; breadth, $2\frac{3}{8}$in.; thickness, $1\frac{3}{8}$in.; weight, 1lb. 1oz.

A very typical specimen of this section is from the Collection of the Mining and Geological Museum, consisting of a dark green, fine-grained diorite (Pl. XXXI., figs. 1 and 2). It was originally a transversely elongated weather-bitten pebble, which has been reduced to the required dimensions both by partially rubbing at the sides and chipping at the butt, which is square-headed, like that of syenitic granite, already described. The cutting edge is very narrow, and obtusely pointed, the bevelled surface being small but beautifully smoothed off and partially polished. Length, 6in.; breadth, 2in.; thickness, $1\frac{6}{8}$in.; weight, 1lb. 3oz.

The largest example of this type is one kindly presented to the Mining and Geological Museum by Dr. J. C. Cox, an elongated pebble of grey argillite, with an imperfect cleavage, which has either been slightly ground all over and smoothed, or become so from gentle attrition in a river bed. The butt is the narrower end, and has been fractured. The anterior end is narrow, and the cutting edge limited in extent, bluntly ground, with many of the scratches, especially those in a transverse direction, remaining. It seems probable that this stone was selected on account of a certain small degree of curvature in the direction of its greatest length, a circumstance also noticeable in the last tomahawk described. Length, $8\frac{1}{2}$in.; breadth, $1\frac{7}{8}$in.; thickness, $1\frac{5}{8}$in.; weight, 1lb. 7oz.

The last implement of this section is equally interesting from the fact that it is quadrangular in section, the fissile nature of the rock, a hornblende schist, apparently having been taken advantage of to cleave, rather than chip, the weapon out of an irregular fragment of rock. The cutting edge is narrow, but well rounded, the well-polished bevel being only on two of the faces of the roughly-shaped rhomb. Length, $4\frac{6}{8}$in.; breadth, $1\frac{5}{8}$in.; thickness, $1\frac{4}{8}$in.; weight, 8oz.

The length and shape of the two largest of the tomahawks described under this section impresses me with the idea that they may have been held in the hand when used, without any form of hafting, probably grasped in the palm rather than held by the fingers as represented by the late Rev. P. MacPherson.* In such a case it would be necessary to transfer them to the third section of our arrangement.

5. *Chisel-shaped Type.* A form of tomahawk rarely met with. I have lately figured one from Port Stephens,† and have two additional now before me. The first was ploughed up from recent alluvium near Hexham, and presented to the Mining and Geological Museum by Mr. R. W. Thompson, M.L.A. (Pl. xxxii., figs. 1 and 2). It is composed of chert of a dull drab colour, derived, Prof. T. W. E. David has no doubt, from a chert bed in the Upper Coal Measures at Nobbys, Newcastle. The implement is oblong, perfectly flat on both sides, slightly increasing in width towards the anterior end, flat along the top and bottom edges, and bevelled on one lateral face only. The bevel is smooth and a little full, but the cutting edge is remarkably true and well rounded. It is slightly flaked at the base. The measurements are :—Length, 8in.; breadth, 2⅞in.; thickness, 1in.; weight, 1lb. 4oz.

The physical character of the matrix has in this instance accommodated itself to the preparation of this implement by breaking up into more or less transversely tabular pieces. This the aboriginal owner improved on by grinding the two faces of one of the ends.

The second tomahawk of this description is rather less in size and thickness than the first. It is probably the one described in the record of the exhibit of Mr. Griffin's tomahawks, "as a flat piece of slate." The composition, as a matter of fact, is greenish-grey altered mudstone or sandy slate. The sides of the tomahawk are smooth and flat, but not polished, square edged, and as might be expected from the comparative tenuity, the amount of the

* Journ. R. Soc. N.S. Wales for 1885 [1886], xix., 2nd Pl., f. 7.

† Proc. Linn. Soc. N. S. Wales, 1890, v. (2), Pt. 2, p. 291, t. 13, f. 11.

[redacted]

bevelled surface is small, and the cutting edge rather obliquely curved. Length, $6\frac{1}{8}$in.; breadth, $2\frac{1}{2}$in.; thickness, $\frac{3}{8}$in.; weight, 6oz.

In the note of explanation referred to, the suggestion is made that these flat tomahawks are "probably used to cut bark." I would enlarge the scope of this happy suggestion by enquiring, is it possible that they were also used for incising the figures and designs employed in decorating trees around graves, or perhaps even Bora grounds?

The late Rev. P. MacPherson figured* a rather similar tomahawk to the above and described it as a "chisel."

Section B.—*With a hafting groove.*

1. *Ovate Type.* A very fine specimen of the grooved tomahawk, for the better reception of the withy, or handle, in hafting, has been communicated by Mr. C. W. De Vis, from the Queensland Museum collection. (Pl. XXXI., figs 3 and 4).

I am not at present prepared to enumerate the number of types which may be found under this heading, the number of illustrations representing them being remarkably small, and their occurrence in collections equally so. I infer, however, that they indicate a higher type of implement than in those cases where the stone head is only hafted with gum.

This tomahawk from Northern Queensland is a long oval in shape, composed of a brown, fine quartzite, heavy and bluntly rounded at the butt, the bevelled anterior sides without signs of friction, but the surfaces roughened and unpolished. The cutting edge has a similar irregularity of outline to so many others, and is not sharp. The groove for the reception of the handle is six-eighths of an inch wide, two-eighths of an inch deep, and is almost equi-distant from both ends. The course of the groove is not directly across the pebble, but is directed forwards on the sides of the tomahawk towards the anterior end. This was doubtless intended to give the handle a better grip of the stone. The measurements are:—Length, $5\frac{1}{2}$in.; breadth, $3\frac{1}{2}$in.; thickness, 2in.; weight, 1lb. 12oz.

* Journ. R. Soc. N. S. Wales for 1885 [1886], xix., 1st Pl., f. 3.

According to Smyth* this is a rare form of tomahawk, and is known as *Pur-ut-three* in Victoria. He figured one from a kitchen midden at Lake Condah, and it was identified by an aboriginal as used for splitting open large trees. It is rather larger than the Queensland implement, being eight inches long and five wide, with a weight of four pounds eight and a-half ounces; the groove is also much nearer the butt.

Two examples of the grooved tomahawk are given by MacPherson† from Telligerry Creek, Port Stephens, N. S. Wales, both slightly larger and heavier than the Queensland implement. The figured example is also much broader across the cutting edge. Mr. MacPherson appeared to be in doubt whether or no these stones might not be used as sinkers as well as tomahawks, but I think little doubt need be entertained that the latter supposition is their true use. The occurrence of grooved tomahawks at distances so far apart as North Queensland, Port Stephens, and Lake Condah, Normanby, Victoria, establishes the wide distribution of this method of hafting.

That we have under the present heading more than one form of tomahawk is, I think, manifest from another figure given by Smyth‡ of an implement found at Winchelsea, in Victoria. In shape it is allied to the small deltoid type of our first section, the butt truncate, and the groove situated far back. It was polished all over and had a keen cutting edge.

This method of hafting is not confined to the rarer form of Australian tomahawk, but was in practice amongst the men of the so-called Neolithic Period, throughout Central and South-western Europe, and was used in connection with tools regarded as hammer-stones or mauls,§ and found usually in the neighbourhood, if not actually in, old mines, "principally copper mines."

* Aborigines of Victoria, 1878, I., p. 368, f. 183.

† Journ. R. Soc. N. S. Wales for 1885 [1886], xix., p. 114, 1st Pl., f. 4.

‡ Aborigines of Victoria, 1878, I., p. 372, f. 195.

§ Evans, Ancient Stone Implements, &c., Gt. Brit., 1872, p. 208.

II.—HAFTED AXES.

Under this name I propose to separate one of the largest forms of stone "tomahawk" used by the Australian aborigines. That such very large and heavy implements as described by the Rev. P. MacPherson from the Paterson River,* measuring $8\frac{1}{2} \times 5\frac{3}{4} \times 1\frac{1}{4}$ inches, and weighing 4lb. 7oz.; from Lake Tyers by Smyth,† measuring $6\frac{1}{2} \times 3\frac{1}{4} \times 1\frac{1}{4}$, and weighing 1lb. $12\frac{1}{2}$oz.; and by myself from Kimberley,‡ were put to the same purposes as the generally smaller tools usually known under the name of tomahawks, is, I think, very improbable, if not negatified by their own weight and appearance. Mr. Smyth also quotes§ a similar large axe from the Paroo River, South-west Queensland. "It is an oval-shaped weapon, highly finished, and, for a great extent around the cutting edge, well polished," measuring 8in. × 6in. × 2in., and about four pounds in weight.

He again remarks: "The natives of some parts of Victoria had large stone axes made of basaltic rock, which were used for splitting trees." One was 8 × 5 × 2, and four pounds eight ounces in weight. Another found at Ballarat was 8 × 4, and about five pounds avoirdupois. These were grooved, and "implements of this size are very rare."||

The forms of these axes, in themselves typical, at once distinguish them from the ordinary tomahawk.

A very fine example has been presented to the Mining and Geological Museum by Mr. H. A. Maclean, from Mogul Creek, Bulloo River, Thargomindah. It is a very large and heavy oval pebble of dark green diorite, the shape of which has been cleverly taken advantage of to produce a large, beautifully curved, and very perfect cutting edge. The widest portion of the axe is immediately at the hind termination of the latter. At the butt slightly and along one of the edges, the bulk has been reduced

* Journ. R. Soc. N. S. Wales for 1885 [1886], xix., p. 115, 1st Pl., f. 5.

† Aborigines of Victoria, 1878, I., p. 366, f. 178.

‡ Proc. Linn. Soc. N. S. Wales, 1890, v. (2), t. 14.

§ *Loc. cit.*, p. 376.

|| *Loc. cit.*, p. 361.

somewhat by chipping, and then quite two-thirds of the surface smoothed by polishing, many of the transverse striæ being still visible in places. The measurements of this fine implement are:—Length, 7$\frac{5}{8}$in.; breadth, 6in.; thickness, 2$\frac{1}{8}$in.; weight, 5lb. 1oz.

The existence of these large implements along the Bulloo River is mentioned by Curr, who, speaking of the Wonkomarra Tribe, inhabiting the river within a radius of twenty miles of Thargomindah, says*: "Their tomahawks, before they obtained iron ones from the Whites, were of green stone, as large as an American axe, the sides rather roughly chipped, and the edges ground and smoothed."

As another example of this type may be taken the axe brought from Kimberley by Mr. W. W. Froggatt, and described in a late paper by myself.† As compared with the present one it is smaller and lighter.

A second axe, sent to me by Mr. De Vis, is slightly larger, and is more securely mounted (Pl. XXXIII.). It is one of the finest examples I have seen, and is from Thornborough, N. Queensland. Like so many others, it is simply a large pebble, oval and flat, and more or less in the rough, the only manipulation it has undergone being the grinding of the cutting edge, which has produced a much less perfect curve than the axe just described from Mogul Creek. The pebble is a dolerite. The measurements are as follows:—Length, 8$\frac{3}{4}$in.; breadth, 5in.; thickness, 1$\frac{3}{4}$in.; weight, 4lb. The handle is a heavy split cane, bent, and passed round the stone, and held in place, like another axe from the Herbert Gorge, by whipping the handle, immediately below the head, with cane riband, but no gum is used. The whip is made doubly secure by passing the free ends over and under, thus as it were forming a collar. The length of the handle doubled is about two feet ten inches. The general aspect of this axe strongly recalls to mind the similar weapons from Lake Tyers in Gippsland figured by Smyth,‡ more particularly as regards the method of tying, the absence of gum mounting, and the shape of the stone heads.

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* The Australian Race, 1886, ii., p. 37.

† Proc. Linn. Soc. N. S. Wales, 1890, v. (2), p. 370, t. 14.

‡ Aborigines of Victoria, 1878, I., p. 366, f. 177, 178.

The late Rev. P. MacPherson has described large axes from N. S. Wales, on which "numerous dints, abrasions, and scratches are strongly suggestive of the device of driving stone pegs between the handle and the hatchet for the purpose of tightening the handle."* Neither of the foregoing axes shows such traces, nor has any example with similar markings yet come under my notice. It is a very peculiar and at the same time suggestive fact that by the means of a bent wooden handle, the whole of the Australian tribes, except some of the West Australians, who have used tomahawks or axes, have so fastened them. They do not appear ever to have hit upon the plan of boring the stone heads for the insertion of a single handle, similar to some of the perforated Neolithic hammers of the Old World.† Indeed, a very interesting circumstance is related by Col. A. Lane-Fox,‡ bearing on this peculiarity. He states§ that a European axe-head was found at an old native camping place, the hole of which the natives, unable to comprehend its object, had carefully filled with their cementing medium, and hafted by means of a withy, bent round the *outside* of the axe-head, in accordance with their traditional custom.||

So far as I can gather, the distribution of these large axes appears to be limited. We have evidence that they were used in Queensland from north to south; the Rev. P. MacPherson knew of their existence in N. S. Wales. On the other hand, Smyth states:¶ "I have never seen any of these large implements in the hands of the natives of Victoria." At the same time, they were evidently in use in the latter colony in former days, for the same author remarks:** "There are found also in the mirrn-yong heaps and in the soil very large tomahawks of different forms, which, it is said

* Journ. R. Soc. N. S. Wales for 1885 [1886], xix., p. 114.

† See Evans' Ancient Stone Implements, &c., Gt. Brit., 1872, p. 196 *et seq.*

‡ Now General Pitt-Rivers.

§ Report Brit. Assoc. Adv. Sci. for 1862 [1863], p. 160.

|| Aborigines of Victoria, 1878, I., p. 374.

¶ *Ibid.*, p. lv.

** *Ibid.*, p. liv.

by the natives, were employed in splitting trees." One of these, found at Daylesford, was nearly fourteen inches in length and five inches in breadth.

Such large and heavy implements are not tomahawks in the strict sense of the word, applying the latter term to forms similar to those described under Section A. Indeed the appearance of the fine tool from Thornborough, with its strong and firmly fixed handle, stamps it at once as an implement more in accordance with our idea of an axe, and could not have been put to such a use as the implement from the Herbert Gorge, to be described shortly.

III.—Hand-Axes and Wedges.

By this term I wish to designate those axes which bear evidence of having been simply held in the hand, and so used, or used as a wedge, rather than mounted in a withy. The Rev. P. MacPherson has drawn attention to this form of axe in the following words:* "Three of the third class of large hatchets are distinguished by another peculiarity they have a piece knocked out of one corner so as to fit to the broad part of the thumb where it spreads out into the hand. They could thus be used without a handle, or when it came off." Speaking of the Cooper's Creek tribes, Mr. A. W. Howitt says: "They grasp the tomahawk with the fingers and thumb, holding the blunt end in the hollow of the hand."†

A tool unmistakably meant to be held in the hand, although no finger-holds are seen, has been forwarded by Mr. C. W. De Vis, found at Toowong, near Brisbane. It seems to have been a rough weather worn piece of rock, with traces of flakes struck off round the edges, but, generally speaking, advantage appears to have been taken of its flattened, large, oval form. A naturally weathered bevelled margin exists on one face, but the other is ground and polished. The peculiarity of this tomahawk, however, lies in the cutting away of the sides at the butt, until a handle has been formed capable of being grasped by the hand. This is, I think,

* Journ. R. Soc. N. S. Wales for 1885 [1886], xix., p. 115.

† Smyth's Aborigines of Victoria, 1878, I., p. 388 *(note)*.

self-evident from the shape of the implement, for in this state it could hardly have been securely fastened between the halves of a bent handle; but in whatever way it was held, the implement was awkward and unwieldy. The cutting edge is unsymmetrical, and the bevel on each face unequal. The stone is a basalt, much weathered. Measurements:—Length, 9$\frac{6}{8}$in.; breadth, 6$\frac{7}{8}$in.; thickness, 1$\frac{1}{2}$in.; weight, 5$\frac{1}{2}$lb.

The Queensland Museum possesses two remarkably good oval axes. One of these (Pl. XXXIV.), a large flat tool composed of a fine micaceous mudstone, from the Herbert Gorge, and a travelled stone or pebble, has had its original form utilised by the cunning aborigine, who has reduced its pristine bulk by rubbing, the irregularly concentric striæ on the surface, arising from the grinding process, being still visible. The broader end has been bevelled off to produce a cutting edge with a similarly wide sweep and truthfulness of outline to the specimen last described. The butt is rather attenuated, the size here having been again reduced by friction above and below. The extremity of the butt is grasped by the flimsiest of withies—a supple stick of *Eremophila*, so Mr. Turner thinks, passed round it and retained in position by a "stop" of black gum, with which the butt is enveloped, but without in any way impinging on the withy, which remains free and loose. The withy is simply bent round the stone head without being fastened in any other way, whether by pegs between the stone and handle, as described by the Rev. P. MacPherson,* or otherwise. In this condition it is held precisely as a blacksmith holds his cold chisel when about to be struck by the hammer. The two portions of the handle are held together, immediately under the head, by a piece of thin split cane. The withy is in one piece, about twenty-two inches long when doubled, and where bent the bark has been removed and the fibre separated to render the bend supple. The bevel is rather flat. The general measurements are:—Length, 8$\frac{1}{8}$in.; breadth, 5$\frac{1}{8}$in.; thickness, 1$\frac{1}{8}$in.; weight, 3lb. 2oz.

One of the most remarkable implements I have yet met with is an axe, triangular in shape, and to some extent resembling the

* Journ. R. Soc. N. S. Wales for 1885 [1886], xix., p. 114.

old-fashioned wood-cutter's axe. It is from Fraser's Island, and is again from the Queensland Museum. The cutting edge is the longest side, the butt being obtusely pointed, the rapidly increasing width, with the slightly concave edges, giving to it the old axe-like form referred to, and which effect may possibly have been heightened by friction. The sides are flat, and the edge is bevelled on one only. It is composed of a hard drab sand rock, and the cutting edge, as might have been expected, is somewhat blunt. The concavity of the upper and lower edges gives to the cutting edge at its ends an upwardly swelling appearance. There are no signs of a hafting groove, flaking of the surface, or abrasions caused by pegs driven to tighten a handle. The measurements of this implement are :—Length, $8\frac{1}{8}$in. ; breadth, $6\frac{5}{8}$in ; thickness, $1\frac{4}{8}$in. ; weight, $2\frac{3}{4}$lb.

Triangular tools of this description seem to be rare, but Smyth records one from Coranderrk, Victoria, but it is not clear whether it was an axe or a tomahawk.

The question naturally arises, are the implements from Toowong, the Herbert Gorge, and Fraser's Island, axes or wedges? I see nothing to prevent them from being wedges, but, on the contrary, a good deal in favour of such a use. In describing the Paterson axe, Mr. MacPherson said*—"its size is suggestive of its having been used as a wedge for splitting," and, "there is an appearance about the edge of this instrument which gives the idea of its having been forced through hard wood." The shape of the implements from Toowong and Fraser's Island renders it difficult to imagine a handle attached, whilst their size is against a simple grasping by the hand. On the other hand, the slight withy placed round the Herbert Gorge instrument, provided it is genuine, is enough to denote its use, that of being held in one hand and struck by some other body, probably a piece of wood. The presence of the withy indicates that it was not a manual weapon in the strict sense of the word, whilst the lightness of the withy equally forbids the use of the instrument as an axe.

* Journ. R. Soc. N. S. Wales for 1885 [1886], xix., p. 115.

Before concluding this part of the subject, I wish to draw attention to a portion of a tomahawk, which is with difficulty referred to its proper place in the series. It forms one of Sir Wm. Macleay's Collection, and is from N. S. Wales. Originally a flattened pebble, it has been further reduced by rubbing, and is unflaked. The interest, however, centres itself in the sharp point the anterior end has been brought to, an unusually pointed end and acute cutting edge for an Australian tomahawk. The finish of the tool is excellent, although the scratches still remain caused by the lateral reduction it has undergone. These are all in one direction. It is composed of a dark green chloritic greywacke, showing faint schistose structure. The rock has probably been derived from the alteration of a mudstone.

It may not be out of place to point out in conclusion a few facts deducible from the study of Australian stone tomahawks in relation to what may be termed their physical structure, derived from the observations of Smyth,* Cox,† MacPherson,‡ Knight,§ Anderson,|| other minor observers, and my own investigations.

Except on the broad lines laid down in the present communication there is no uniformity in size or shape, but whether tomahawks or axes, they are usually longer than broad, the exception being our third type of Section A, Group I.

There appear to have been three well marked methods of preparation :—(1) Shaped by directed blows only; (2) The same accompanied by the polishing of the cutting edge; (3) Selected pebbles, polished at the cutting edge, but not shaped or flaked.

As a rule, stones flattened laterally were selected, and following this conception, the choice seems to have been given to water-worn pebbles.

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* Aborigines of Victoria, 1878, I., pp. liv. and 365.

† Proc. Linn. Soc. N. S. Wales, 1875, I., p. 21.

‡ Journ. R. Soc. N. S. Wales for 1885 [1886], xix., p. 113.

§ Report Smithsonian Institution for 1879 [1880], p 213.

|| Records Geol. Survey N. S. Wales, 1890, ii., Pt. 2, pp. 73-81.

The smoothed and polished portions of these implements vary greatly in extent and finish, and seem to have been studied only so far as to produce an efficient cutting edge. Grinding may have taken place alone, or grinding and polishing may occur conjointly in the same implement. Such a thing as a wholly polished tomahawk, without the assistance of a natural agent, has never come under my notice.

The cutting edge is, with remarkably few exceptions, always curved, and the curvature very rarely amounts to a semicircle. Mr. William Anderson, however, cites two exceptions to this rule, one a pebble from the conglomerate of the Gundabooka Mountain, to the west of Bourke, in which the cutting edge is "nearly straight." A straight cutting edge is also exemplified in the third tomahawk of the deltoid or subtriangular type under Section A. The cutting edge is at times ground very sharp; "so sharp," says Rear-Admiral P. P. King, "that a few blows serve to chop off the branch of a tree.*

The butt is never worked, only chipped; but the production of tomahawks by chipping alone is very rare throughout Central and Eastern Australia, although common in Western Australia. Mr. Anderson mentions two examples from N. S. Wales.† Chipped weapons are flaked from the edges inwards, the size of the flakings decreasing in size forwards. The sides are sometimes grooved to assist in firmly attaching the handle.

Single stones appear to have been universally used over the entire Continent, with the exception of Western Australia, where two are employed, attached to the same handle, placed butt to butt, and united in the hafting.

Tomahawk or axe heads perforated for the reception of a handle are unknown, with the exception of an instance recorded by Dr. J. C. Cox,‡ which appears to point in that direction. He says—"But specimens I have only recently received from the Macdonald

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* Intertrop. Coasts of Australia, ii., p. 69.

† Records Geol. Survey, *loc. cit.*, p. 77.

‡ Proc. Linn. Soc. N. S. Wales, 1875, I., p. 23.

River, a tributary of the Hawkesbury, lead me to assume that in some instances the handles were fixed in the centre of the stone, so that both edges were used."

The bevel varies considerably, and depends for its extent on the original thickness of the stone employed. It is always convex or arched, but seldom ever bilaterally symmetrical.

It is possible for general classificatory purposes to separate our stone implements of this description into three broad sections:—A. Tomahawks; B. Axes; C. Hand-Axes and Wedges.

The use of such stone implements is not universal throughout Australia, for Curr informs* us that certain tribes in his Western Division, and the western part of his Central Division, or the Minung Tribes do not use tomahawks at all.

As regards the hafting of tomahawks, six methods were known:—(1) The handle formed of a single piece, and attached by a heavy swathing of gum; (2) As a withy passed over the stone head and secured *(a)* with gum alone, or *(b)* gum and lashing; (3) As a withy reposing in the grooved sides of the head; (4) Similar to last, but handle twisted on itself;† (5) Head lashed to the handle after the fashion of the New Zealander or Dyak;‡ (6) Head fixed with lashing and gum in a cleft stick.§

The composition of the cementing medium varies considerably in different tribes.

XVII.—*Modernised Aboriginal Tomahawks.*

In a recent Paper, after describing some flint knives, I showed the adoption and continuity of the aboriginal idea when brought in contact with articles of European manufacture. The rapidity with which the black abandons his stone tomahawk in favour of the white man's iron instrument is well known, but amongst the

* Australian Race, 1886, I., pp. 287 and 367.

† In South Australia, see Knight, Report Smithsonian Inst. for 1879 [1880], p. 237, f. 38b.

Said to be Australian by J. G. Wood, Nat. Hist. Man. 1870, p. 32, f. 2.

§ Evans, Stone Implements Gt. Brit., 1872, p. 151.

half-civilized this seems to have been preceded by the adoption of both aboriginal and civilized materials. Thanks again to Mr. De Vis, I am able to show this by the four following implements, all made of scrap-iron, picked up, or, more probably stolen, and converted into tomahawks in the usual way by passing a withy round and securing the head with gum.

The first implement is formed of a large piece of flat iron, nine and a-half inches long and three and a-half wide ; but it is very difficult to say what it has formed a part of, unless it be part of a wheel tire (Pl. xxxiv.). It has been severed at the butt from the remainder simply by means of cutting. The two faces of the anterior end have been ground in the usual way, producing the bevelled surfaces and cutting edge. The handle is one foot in length, and it weighs three pounds eleven ounces. This probably represents an axe.

The second implement has been made in a precisely similar manner, but the top edge of the iron is concave, and the bottom horizontal. Had the lower edge been convex, I should have suggested that this had once formed a portion of a small wheel tire. The head is held in place by gum, and a string collar is passed round under it. I think we may justly regard this as a tomahawk ; it measures four and a-half inches long and two and a-half wide. The handle is ten inches.

The third presents no difficulties whatever in regard to the object selected to form the head. It is a piece of a horse-shoe (Pl. xxxvi.), six inches in length, and differs from the former specimens in that it is single-headed. The iron is securely fastened by an over and over lashing of a rush-like plant, and the whole enveloped in gum. The handle is fifteen and a-half inches long, and together with the head producing a very handy and efficient weapon as well as implement. It is from the Walsh River, and forcibly recalls to mind the peculiar quartzite-headed axe I figured* some time ago from Northern Queensland.

The fourth, and last, is equally cunningly adapted, and is formed either of a cold-chisel or a ship's bolt. The head of the chisel

* Proc. Linn. Soc. N. S. Wales, 1890, v. (2), t. 12, f. 14.

forms the butt, and the chisel edge the cutting portion. The former is exposed from the gum mounting, and probably served the purpose of a hammer. The lashing in this instance seems to be string, and is thickly coated with gum. The chisel is five and a-half inches long, and the handle one foot three inches.

The horse-shoe iron and the chisel are not confined by a collar holding the two halves of the handle together, but are held in position as described by string and gum. Neither of the handles is tied at the base, similar to the method of doubly securing some of those of stone tomahawks.*

EXPLANATION OF PLATES.

Plate xxix.

Fig. 1.—Tomahawk (oblong-ovate type), highly finished, of greenish-black diorite. Braidwood; Mr. J. W. Penney. ½ nat.

Fig. 2.—Side view of the same.

Fig. 3.—Tomahawk (oblong-ovate type), flaked, of silicified claystone. New England; Mining and Geological Museum (Mr. Blomfield).

Fig. 4.—Side view of the same.

Plate xxx.

Fig. 1.—Tomahawk (ovate type), of a felspathic quartzite. Macleay Collection.

Fig. 2.—Side view of the same.

Fig. 3.—Tomahawk (deltoid type), of dark green diabase (?) Normanton, Queensland; Queensland Museum (Mr. C. W. De Vis).

Fig. 4.—Side view of same.

Plate xxxi.

Fig. 1.—Tomahawk (gad-shaped type), of a dark green diorite. N. S. Wales; Mining and Geological Museum.

Fig. 2.—Side view of the same.

Fig. 3.—Tomahawk with a hafting groove (ovate type). North Queensland; Queensland Museum (Mr. C. W. De Vis).

Fig. 4.—Side view of the same.

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* See Smyth, Aborigines of Victoria, 1878, I., p. 367, f. 179, p. 368, f. 181.

PLATE XXXII.

Fig. 1.—Tomahawk (chisel-shaped type), drab-coloured chert. Hexham, N. S Wales; Mining and Geological Museum (Mr. R. W Thompson).

Fig. 2.—Side view of the same.

PLATE XXXIII.

Axe, hafted, a large pebble of dolerite. Thornborough, Queensland; Queensland Museum (Mr. C. W. De Vis).

PLATE XXXIV.

Wedge, with a slight withy handle. Herbert Gorge, Queensland; Queensland Museum (Mr. C. W. De Vis).

PLATE XXXV.

Axe, modernised; made of portion of a wheel tire. North Queensland; Queensland Museum (Mr. C. W. De Vis).

PLATE XXXVI.

Tomahawk, modernised; formed of portion of a horse-shoe. Walsh River; Queensland Museum (Mr. C. W. De Vis).

NOTES AND EXHIBITS.

Rev. Dr. Woolls sent for exhibition specimens of lerp or manna —some still *in situ* on the branchlets—from *Eucalyptus pulverulenta*, Sims, found at Buckley's Crossing; manna is frequently met with on *E. viminalis*, Labill., (formerly called *E. mannifera*), and a few other species, and occasionally on *E. punctata*, DC., but this is the first instance of its occurrence on *E. pulverulenta* known to Dr. Woolls.

Also, portion of an unusually fine specimen of a lichen, *Usnea articulata*, Ach., several feet long, recently brought from New England by Mr. C. S. Wilkinson, F.G.S.; and a specimen of another remarkable lichen, *Cladonia retipora*, Flœrke, a species common to Australia, Tasmania, and New Zealand.

Rev. J. Milne Curran exhibited a stalactite of metallic copper, showing obscure crystalline facets. The mass, which weighs 7¼lbs., was found at Cobar in a cavity in carbonate of lime, hanging by a single thread of metallic copper. The copper was evidently deposited from solution by some inexplicable reactions.

Mr. Etheridge exhibited a very fine series of Aboriginal Tomahawks and Axes in illustration of his Paper.

Mr. Maiden sent for exhibition a quantity of seeds of the sugar-cane from Barbadoes, with the intimation that he would be glad to furnish growers in the Northern River Districts with samples for experimental cultivation.

Mr. Froggatt exhibited some living beetles (*Axionichus insignis*, Pascoe, fam. *Curculionidae*), which afford a good example of protective coloration. They were found a few days since at Wellington, N.S.W., on the trunks of Kurrajong trees (*Sterculia*), the bark of which they resemble so closely in tint and general appearance that it was quite by accident he first recognised their true character.

WEDNESDAY, 26TH AUGUST, 1891.

The President, Professor Haswell, M.A., D.Sc., in the Chair.

The Minutes of the previous Meeting were read and signed.

The Chairman announced to the Meeting with deep regret the death, only that morning, of the Government Geologist, Mr. CHARLES SMITH WILKINSON, F.G.S., F.L.S. Mr. WILKINSON was an Original Member of the Society, for several years was a Member of the Council, in the years 1883 and 1884 was President, and since 1885 had been one of the Vice-Presidents. His enthusiasm in the cause of Geological Science, his extensive knowledge of the geological features of Eastern Australia, his many personal qualities, and his decease at the comparatively early age of 47, combine to render his loss one which will be severely felt.

On the motion of Mr. Henry Deane it was resolved that a letter of sympathy from the Meeting be sent to Mrs. Wilkinson.

The reading of papers and other business was deferred, and the Meeting then adjourned to September 30th.

WEDNESDAY, 30TH SEPTEMBER, 1891.

The President, Professor Haswell, M.A., D.Sc., in the Chair.

Dr. F. Fick, Sydney, was elected a member of the Society.

A letter from Mrs. C. S. Wilkinson, thanking the Members of the Society for their expression of sympathy, was read to the meeting.

The President announced that the Council had elected Professor Sven Lovén, M. & Ph. D., of Stockholm, and Professor S. P. Langley, LL.D., of the Smithsonian Institution, Washington, Honorary Members of the Society.

DONATIONS (received since the July Meeting).

"Journal of the Royal Microscopical Society, 1891." Parts 3 and 4 (June and August). *From the Society.*

"Transactions and Proceedings of the New Zealand Institute." Vol. xxiii. (1890). *From the Director, Colonial Museum.*

"Transactions of the Royal Society of South Australia." Vol. xiv., Part 1 (1891). *From the Society.*

"Zoologischer Anzeiger." xiv. Jahrg., Nos. 366-370 (June, July, and August, 1891). *From the Editor.*

"Perak Government Gazette." Vol. iv., Nos. 18-28 (June, July, and August, 1891). *From the Government Secretary.*

"Abhandlungen herausgegeben vom naturwissenschaftlichen Vereine zu Bremen." xii. Bd., 1 Heft (1891). *From the Society.*

"The Victorian Naturalist." Vol. viii., Nos. 4 and 5 (August and September, 1891). *From the Field Naturalists' Club of Victoria.*

"Plants Indigenous and Naturalised in the Neighbourhood of Sydney." By W. Woolls, Ph.D., F.L.S. New Edition (1891). *From the Field Naturalists' Society of N.S.W.*

"Zoological Society of London—Transactions." Vol. xiii., Parts 1 and 2 (1891); "Proceedings, 1891," Part 1. "Abstract," June 16th, 1891. *From the Society.*

"Sydney Free Public Library—Report from Trustees for 1890." *From the Trustees.*

"Department of Agriculture of Victoria—Bulletin." Nos. 8 and 12 (August, 1890, and July, 1891). *From the Secretary for Agriculture.*

"Transactions of the Entomological Society of London, 1891." Part 2 (June). *From the Society.*

"Bulletin of the American Geographical Society." Vol. xxiii., No. 2 (June, 1891). *From the Society.*

"Kongliga Svenska Vetenskaps-Akademie—Handlingar." Bd. v. (Part 2)—xxii. and three Atlases (1864-87); "Bihang till Handlingarne." Bd. i.-xi., xii. (Parts 1 and 2), xiii. (Parts 1 and 2), xiv.-xv. (1872-90); "Oefversigt af Forhandlingarne" Arg. 1865-1889; "Lefnadsteckningar." Vols. i., ii. (1869-85); "Forteckning ofver innehallet i K. Vet. Akads. Skrifter (1826-83);" "Carl von Linné's Brefvexling—Forteckning af E. Ahrling" (1885); "K. Svenska Fregatten Eugenies Resa omkring Jorden, 1851-53;" "Insecta Caffraria. Auctore C. H. Boheman." Parts 1 and 2 (1848-57); "Monographia Cassididarum. Auctore C. H. Boheman." T. i.-iv. (1850-62); "Hemiptera Africana descripsit C. Stal." T. i.-iv. (1864-66): and the following works by C. J. Sundevall—"Die Thierarten des Aristoteles," &c. (1863); "Conspectum avium Picinarum" (1866); "Methodi naturalis avium disponendarum Tentamen" (1873). *From the Royal Swedish Academy.*

"Proceedings of the American Academy of Arts and Sciences." Vol. xxv. (1889-90). *From the Academy.*

"Journal of the Cincinnati Society of Natural History." Vol. xiii., No. 4. *From the Society*

"New York Academy of Sciences—Annals." Vol. v., Nos. 4-8, and Index to Vol. iv.; "Transactions." Vol. ix., Nos. 3-8 (1889-90). *From the Academy.*

"Johns Hopkins University Circulars." Vol. x., No. 91 (July, 1891); "Studies from the Biological Laboratory." Vol. iv., No. 7 (1890). *From the University.*

"Proceedings of the American Philosophical Society." Vol. xxviii., No. 134 (July-December, 1890). *From the Society.*

"Journal of Comparative Neurology." Vol. i., Part 2 (June, 1891). *From the Editor, Professor C. L. Herrick.*

"Proceedings of the Rochester Academy of Science." Vol. i., Brochure 1 (1890). *From the Academy.*

"Proceedings of the Academy of Natural Sciences of Philadelphia for 1890." Parts 2 and 3. *From the Academy.*

"Annual Report of the Board of Regents of the Smithsonian Institution for the Year ending June 30, 1888." *From the Smithsonian Institution.*

"The Missouri Botanical Garden." First Annual Report (1890). *From the Director.*

"Journal of Comparative Medicine and Veterinary Archives." Vol. xii., Nos. 6-8 (June-August, 1891). *From the Editors.*

"Bulletin of the Museum of Comparative Zoology at Harvard College." Vol. xxi., Nos. 2-4 (May and June, 1891). *From the Curator.*

"United States Department of Agriculture—Division of Entomology—Bulletin." Nos. 23 and 25 (1891). "Insect Life." Vol. iii., Nos. 9 and 10 (June, 1891). *From the Secretary of Agriculture.*

"Geological and Natural History Survey of Canada—Contributions to Canadian Palæontology." Vol. i., Part 3 (1891). *From the Director.*

"Verhandlungen der k. k. zoologisch-botanischen Gesellschaft in Wien." xl. Bd., 3 u. 4 Heft (1890). *From the Society.*

"Bulletin de la Société Belge de Microscopie." xvii^{me} Année, No. 8 (1891). "Annales." T. xv. (1891). *From the Society.*

"Gesellschaft für Erdkunde zu Berlin—Zeitschrift." xxv. Bd., 6 Heft (1890); "Verhandlungen." Bd. xviii., Nos. 4 u. 5 (1891). *From the Society.*

"Koniglich-Bohmische Gesell. der Wissenschaften in Prag—Sitzungsberichte." Jahrg. 1890, ii. Bd.; "Jahresbericht, 1890." *From the Society.*

"Catalogue of Mammalia in the Indian Museum, Calcutta." Part 2. By W. L. Sclater, M.A., F.Z.S. (1891). *From the Trustees.*

"Queensland—Report on the Gympie Gold Field" and "On the Albert and Logan District." By W. H. Rands (1889). *From R. Etheridge, Jun., Esq*

"Queensland—Report on proposed Boring for Water at Brisbane." By R. L. Jack (1890); "Second Report on Tin Mines near Cooktown." By R. L. Jack (1891); "Notes on Broken Hill." By R. L. Jack (1891): "Report on Cape River Gold Field." By W. H. Rands (1891); "Report on Paradise Gold Field." By W. H. Rands (1891); "Report on Coolgarra Tin Mines, &c." By A. G. Maitland (1891); "Report on the Geology of the Cooktown District." By A. G. Maitland (1891). "Report on Geology and Mineral Resources of the Upper Burdekin." By A. G. Maitland (1891). *From the Government Geologist, Queensland.*

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PAPERS READ.

THE EXAMINATION OF KINOS AS AN AID IN THE DIAGNOSIS OF EUCALYPTS.

PART III.—THE TURBID GROUP.

By J. H. Maiden, F.L.S., F.C.S.

My third large group of kinos I call the turbid group,—certainly a descriptive name, as the members of it all form turbid solutions in water, owing to the presence of catechin. This sharply defines them from the other two groups. Another characteristic is their extreme friability.

This group contains a more heterogeneous collection of substances than do the other two, but beyond submitting a few suggestions as to the affinities of certain kinos comprehended in it, I do not propose to form additional groups at present, until the number of authentic specimens worked at by other observers or myself is very largely increased.

It follows, from the friable nature of kinos of this group, and the way in which they fall to pieces as soon as they get dry, that "Turbid Kinos" are always in small fragments, while the ruby and gummy ones are frequently in agglutinated masses of a considerable size, which require some force to break up. As a consequence of the foregoing the percentages of moisture are comparatively low.

Description of a typical Kino of the Turbid group.

Colour reddish-brown, with the following exceptions: *E. maculata*, *E. microcorys*. Most of them, perhaps all, possess an odour, at least when perfectly fresh. Bright looking when perfectly

fresh and unhandled, but, in a few weeks in small fragments, dulled by their own disintegration. They powder readily between the fingers, forming a fine powder which, in the majority of instances, is of a buff colour.

What this Kino research enables us to do.

1. To pronounce whether a kino is the product of a Eucalypt belonging to the Renantheræ or not.

2. To confirm the affinity existing between stringybarks, ironbarks, boxes, &c. It is a useful adjunct to, and check upon, the cortical system, which is of course founded on external characteristics merely. Eucalypts sometimes have variable bark, but, as far as known, the kino of a particular species is constant in character.

3. To furnish a guide in points of difficulty which arise in cases where diagnosis in the ordinary manner (*e.g.*, by flowers and fruits) breaks down. See *leucoxylon*, *fasciculosa*, infra.

4. To name, in some instances (*e.g.*, *maculata*, *corymbosa*), a species from kino alone.

5. To state whether a kino contains catechin from physical characteristics alone.

6. To pronounce what species are suitable for tincture-making and what are unsuitable. Partly dependent on the foregoing we are now in a position to indicate what species satisfy the requirements of pharmacopœias for kino, and what do not.

It must be remembered that the systematic examination of kinos is only just beginning.

I desire to express my obligations to Mr. H. G. Smith, Laboratory Assistant, Technological Museum, for valuable assistance in this research.

Attention is drawn to the fact that the kinos of *Eucalyptus maculata* and *E. microcorys* are anomalous; they differ from the others in regard to colour, so much so, that they can be singled out from all others (so far as is at present known) by this colour-test

alone. At the same time, other kinos tend to this colour, and it may be that a regular gradation of kino-colours will be found, as our knowledge of authentic species of these substances increases.

It is also worthy of note that *E. microcorys* is the only* kino of the turbid group belonging to the Renantheræ. Its resemblance to that of *E. maculata* is very marked, and it is as different as possible from any other Renantherous kino. It is worth enquiring of what value this observation may be, as bearing upon the affinities of *E. microcorys.*

The order in which kinos belonging to this group are placed is only provisional, as at present under 30 species belong to the group as the result of absolute experiment, and very much more material requires to be accumulated, in order that one may be in a position to subdivide it with any degree of finality. It promises to be the largest of the kino groups, and while already I can predict a number of species which will fall into it, I confine myself strictly to facts. Following are the species referred to in this paper :—

E. hemiphloia
" " var. *albens* = *E. albens*
E. odorata
E. melliodora
E. fasciculosa (non *E. paniculata*, Sm.)
E. corynocalyx
E. leucoxylon (non *E. sideroxylon*, A.Cunn.)
E. cornuta
E. rostrata
E. viminalis
E. Stuartiana
E. Maideni
E. Gunnii
E. goniocalyx
E. Bäuerleni

* The only species of the Renantheræ I have not examined is *E. acmenoides ;* see p. 606, Vol. iv., Series 2.

E. punctata
E. longifolia
E. corymbosa
E. terminalis
E. eximia
E. clavigera
E. tessellaris
E. maculata
E. microcorys

and, as the results of the experiments of others :—

E. calophylla
E. globulus
E. trachyphloia

"Box" Provisional Sub-Group

E. hemiphloia
E. odorata
E. melliodora.

E. fasciculosa kino seems to form a kind of connecting link between these and

E. corynocalyx
E. leucoxylon
E. cornuta

Eucalyptus hemiphloia, F v.M., B.Fl. iii. 216

No. 35. "Box" or "White Box." Nerriga, N.S.W. Kino collected October, 1888. Height of trees, 80-120 feet. Diam., 2-3 feet.

A freshly exuded, more than ordinarily bright-looking kino. It very much resembles light seed lac in colour and general appearance. Friability and colour of powder normal. Its composition is :—

Catechin and tannic acid	78·4
Gum	nil
Ligneous matter, &c.	2·3
Moisture	19·2
Ash	·1
	100·00

Tannic acid determination (Löwenthal), 34·539 per cent. This kino was analysed November, 1888.

The catechin and tannic acid in these kinos were determined together by extraction with alcohol. The tannic acid was separately determined by Löwenthal's process (on an original aqueous solution). I cannot go further, in this place, into the chemical questions involved; this will be dealt with in a monograph on the whole subject of kinos. I may mention, however, that Löwenthal's process is only of limited application in the determination of tannic acid in turbid kinos, and the figures given in this paper of Löwenthal determinations have comparative values only. For medicinal or tanning purposes, the results obtained by Löwenthal's method will be a guide as far as practical astringent value is concerned.

No. 36. "Box." Dromedary Mountain, Tilba Tilba, N.S.W.; collected September, 1889, from trees 80-120 feet in height, and with a diameter of 2-4 feet.

This kino resembles the previous one so closely that no second description is necessary.

No. 37. Sample from Wagga Wagga, N.S.W.; collected October, 1889. Tree known locally as "Grey Box."

Collected and presented by Mr. J. J. Fletcher, M.A., B. Sc., Director of this Society, who described its appearance as like a boss, and that it had thrust up the bark of the tree as if it had been so much paper. The sample principally consists of a large oval mass, over an inch in thickness; it had solidified in this shape while adherent to the bark; externally it is of a dull brown colour; on the freshly fractured surface it is bright in appearance.

Friability normal, the colour of the powder being a very light buff. It contains a large amount of catechin. This sample may be taken as one of the most strongly defined of the kinos of this group yet examined by me, and may be considered as an extreme type; the amount of catechin remaining as a very light yellowish powder after the tannic acid has been dissolved out with cold water is very large; on standing the water does not become clear. Analysis (made August, 1891) shows its composition to be:—

Catechin and tannic acid ...	84·43
Ligneous matter, &c.	4 0
Moisture	9·94
Ash	1·63
	100·00

Tannic acid determination (Lowenthal), 15·2 per cent.

No. 38. I have received a specimen of kino, also from the Wagga Wagga district, labelled "White Box, *E. populifolia.*" From its composition and general appearance, and also partly because *E. hemiphloia* is the common "White or Grey Box" about Wagga, I am inclined, as I am unable to get herbarium specimens to settle the matter, to place this kino with *E. hemiphloia*. In fact, I look upon this as an instance of the usefulness of kinos as a check upon species-naming.

This kino is dull in appearance. Friability normal; colour of powder light buff or raw sienna. It does not dissolve entirely in water, the catechin remaining as a light yellow powder; the colour of the water is that of a weak infusion of tea; it remains slightly turbid.

Analysis (made August, 1891) shows it to be composed of:—

Catechin and tannic acid ...	90·05
Ligneous matter, &c.	·4
Moisture	8·71
Ash	·84
	100·00

Tannic acid determination (Lowenthal), 14·5 per cent.

No. 39. I have received (July, 1891) a sample of kino, most probably collected in Victoria, and labelled "*E. hemiphloia*." It is tough, not the least friable, of a dark reddish-brown colour externally, but by transmitted light it is of a bright ruby colour. Its physical characteristics are quite different from kinos of the turbid group hitherto examined by me. I do not hesitate to say that the tree producing it, although ranking under *E. hemiphloia*, is specifically distinct. I draw attention to the subject, as a revision of the trees grouped under *E. hemiphloia* may be desirable.

EUCALYPTUS HEMIPHLOIA, F.v.M. var. ALBENS (Syn. *E. albens*, Miq.), B.Fl. iii. 219.

No. 40. "Northern Box" of South Australia. Kino from South Australia, received from Baron von Mueller, August, 1891. Physical properties same as the normal species, and as will be seen below, the chemical properties are very similar also. Composition (determined August, 1891):—

Catechin and tannic acid ...	89·112
Ligneous matter	·89
Moisture	9·008
Ash	·99
	100·000

Tannic acid determination (Löwenthal), 16·9 per cent.

EUCALYPTUS ODORATA, Behr, B.Fl. iii. 215.

No. 41. Kino from a variety known as "White Box" at Wongrabell, near Eden, N.S.W. Diam., 6-8 feet. Height, 100-150 feet; collected February, 1887. Apparently an old sample, and much contaminated with bark. Dull-looking, prevailing colour brown, and readily crumbling between the fingers to a brown powder. Its composition (determined October, 1888) is as follows:—

Catechin and tannic acid ...	78·24
Ligneous matter, &c.	1·66

Moisture	19·3
Ash	·8
	100·00

Tannic acid determination (Löwenthal), 23·873 per cent.

EUCALYPTUS MELLIODORA, A. Cunn., B.Fl. iii. 210.

No. 42. The ordinary "Yellow Box." Kino received from Baron von Mueller, July, 1891. In very small pieces of a light brown colour, both in colour and appearance resembling small currants; powders between the fingers to a light yellow colour. I have not sufficient for a complete investigation, but I place it here from a general examination.

EUCALYPTUS FASCICULOSA, F.v.M. in Trans. Vict. Inst. Vol. I (1854).

This species has long been looked upon as a form of *E. paniculata*, Sm. (see B.Fl. iii. 211, and Decade 5, Mueller's *Eucalyptographia*). As the discrimination of the two species is important, I think it necessary to go into the matter with a little detail.

Under the name of *E. paniculata* are usually enumerated two distinct trees, viz.:—A New South Wales ironbark (the tree on which Smith founded the species), and a (Victorian and) South Australian white gum, with smoothish white bark as its name denotes. The timbers of the two trees are also totally different. This confusion caused Bentham to write (B.Fl. iii. 211), "The notes on the bark uncertain." In making a rough grouping of Eucalypts according to the vernacular names, he adopts the name "White Gum," B.Fl. iii. 189, and leaves it out of the list of "Ironbarks."

I give a few notes on the trees known as *E. paniculata* in the colonies of New South Wales, Victoria, and South Australia. I have not dwelt upon the inflorescence and fruits, as these are palpably similar in the various trees referred to, and afford an instance in which determinations from such material break down. To discriminate between certain Eucalypts, the bark, timber, or kino (or all three), should be taken into consideration.

New South Wales.—"She Ironbark" (Woolls, B.Fl. iii. 211). It is the "Red Ironbark" of the Southern Coast districts (*E. paniculata*); var. *angustifolia* is "Narrow-leaved Ironbark" (Woolls, B.Fl. iii. 212).

Victoria.—Bark persistent, hard and rough, or by outer decortication whitish and smooth outside. "The Box-Ironbark Tree" (Mueller), *Dichotomous Key.* This is *E. fasciculosa.*

South Australia.—"White Gum" (Behr, B.Fl iii. 212). It is gured in Brown's *Forest Flora of S.A.* and called by him "Panicle-flowered White Gum" in order to distinguish it from the other white gums of that colony. From the description of the bark, and the figure of it given, it is at once seen that the South Australian *paniculata* (*E. fasciculosa*) is quite a different species from our New South Wales ironbark of that name. The colour of the South Australian timber is not given; that of our ironbark is medium red.

No. 43. Kino received from W. Gill, Esq., F.L.S., Conservator of Forests, South Australia, July, 1891. Known locally as "White Gum."

The physical properties of this kino resemble those of a typical kino of the group. Composition (determined August, 1891):—

Catechin and tannic acid ...	83·384
Ligneous matter, &c.	·6
Moisture	15·78
Ash	·236
	100·000

Tannic acid determination (Löwenthal), 24·1 per cent.

EUCALYPTUS CORYNOCALYX, F.v.M. B.Fl. iii. 218.

The Sugar Gum of South Australia. "Slowly but completely soluble in water; solution slightly acid, yellow-red, on cooling turbid, no gum-resin. Broken reddish-brown lumps, fatty lustre, mixed with particles of bark" (Wiesner, Zeitschr. d'allg. Œst. Apotheker-Vereines, 1871; Pharm. Journ. [3] ii. 102).

No. 44. A specimen received from W. Gill, Esq., F.L.S., Conservator of Forests, S.A., July, 1891, is in small pieces, very dull externally. Friability normal. Colour of unground kino a dull sienna-brown, colour of powder ochre-yellow.

It does not entirely dissolve in cold water; the supernatant liquid is pale yellowish, and it does not entirely dissolve in alcohol; the liquid becomes clear on standing, but on agitation has a very turbid appearance. Its composition (determined August, 1891) is:—

Catechin and tannic acid ...	82·471
Ligneous matter, &c.	3·827
Moisture	13·370
Ash	·332
	100·000

Tannic acid determination (Lowenthal), 26·2 per cent.

EUCALYPTUS LEUCOXYLON, F.v.M. B.Fl. iii. 209, and Decade 1, Mueller's *Eucalyptographia.*

Under the above name two distinct trees have been included, viz.:—A New South Wales ironbark, and a white or blue gum found in Victoria and South Australia. The New South Wales tree is *E. sideroxylon*, A. Cunn., the southern one is *E. leucoxylon*, F.v.M., a tree with a pale-coloured wood as its name denotes, while the N.S.W. ironbark has red timber, and also one of quite a different character to the other. I give notes under the heading of each colony to help to set the matter clear, and would point out that in this instance examination of the kinos is a valuable help, showing that the products of the N.S.W. ironbark and the Victorian or South Australian white gum are very different.

New South Wales. Syn. *E. sideroxylon*, A. Cunn.—The "Red Flowering Ironbark"; it, however, sometimes has white flowers. Red ironbark of Mudgee district (Hamilton) and other parts of the colony.

In a "Note on *Eucalyptus leucoxylon*, F.v.M.," by the Rev. Dr. Woolls (P.L.S.N.S.W. [2], i. 859), this matter of the confusion

[redacted]

which has arisen between the two trees is clearly set forth, and I am but emphasizing Dr. Woolls' remarks in the paper referred to. I have for some years been impressed with their specific differences, and the use of the name *leucoxylon* in my former paper (P.L.S.N.S.W. [2], iv. 1277) for *sideroxylon* is a slip of the pen.

Victoria.—Bark either rugged, hard, dark and persistent, or decorticating and then smooth and whitish outside. The "Victorian Iron-bark Tree" (Mueller, *Dichotomous Key*); see also *Eucalyptographia*, where it is stated:—" This is the iron-bark tree of Victoria and many districts of New South Wales." This is a slip of the pen as regards Victoria, the tree being not a true iron-bark in that colony, although sometimes having rugged bark about the butt. The Victorian species varies somewhat in bark in different localities.

Mr. W. R. Guilfoyle, exhibiting Victorian *E. leucoxylon* timber at the Sydney International Exhibition of 1879, describes it as " Milk white Gum or Spurious Iron-bark. Said to be synonymous with *E. sideroxylon*, the true iron-bark, although very distinct in appearance."

It is called " Iron-bark " in Howitt's paper (Trans. R. S. Vict. II. pt. 1). It is called " Box" at p. 215, and "Spurious Ironbark" at p. 226 of the Official Record, Intercol. Exh. of Australasia, Melbourne, 1867, a scientific publication of great value.

South Australia.—Figured as the "Blue Gum" in J. E. Brown's " Forest Flora of S.A." The specimens on which the species-name *leucoxylon* was founded by Baron Mueller, were obtained from near Adelaide. Known also in South Australia as "White Gum."

" On the matured trees the bark upon the stem is hard, woody, rugged, and of a dark bluish-grey—sometimes almost black—on the surface and brown beneath ; it falls off in curled, broken up, longitudinal pieces two or three feet long, and from a-half to one inch in thickness" (J. E. Brown). This is, of course, quite different to an ironbark.

Queensland.—The following note on a Queensland form of *leucoxylon* has no direct bearing on the point at issue (viz.

sideroxylon and *leucoxylon* being distinct species), but I give it for completeness. The typical *E. sideroxylon* does not appear to extend to Queensland.

"*E. leucoxylon*": bark white on the branches, more persistent on the trunk; var. *minor*, C. Ext. (Bailey). See also Scortechini, P.L.S.N.S.W. viii. 248, who states that this variety barely crosses the boundaries of Queensland, near Wilson's Peak, South Queensland.

Memo.—Bentham (B.Fl. iii. 210) states "this variety seems almost to pass into *E. melliodora*," and certainly the kino of that species and that of *E. leucoxylon*, F.v.M., strongly resemble each other.

No. 45. "Blue Gum" of South Australia. Kino received from Mr. W. Gill, F.L.S., Conservator of Forests, South Australia. July, 1891.

This is apparently a freshly exuded sample, being very bright and sparkling in appearance. Its general colour is a warm sienna brown; it is easily reducible to a powder between the fingers, such powder having a bright yellow colour, almost chrome. It is very new, which accounts for some of the brightness of colour. Its general behaviour at once places this kino in the turbid group.

Behaviour and appearance in water similar to *E. corynocalyx* sample. In alcohol it does not entirely dissolve, the supernatant liquid is bright, clear, and of a reddish-brown colour; the liquid is very turbid when agitated.

Its composition (determined August, 1891) is —

Catechin and tannic acid ...	79·279
Ligneous matter, &c.	4·9
Moisture	14·95
Ash	·871
	100·000

Tannic acid determination (Lowenthal) 21·5 per cent.

MM. E. Heckel and Fr. Schlagdenhauffen (*Le Naturaliste*, July 1, 1890, p. 151) have been experimenting upon some kinos

of *E. leucoxylon* and *E. viminalis* received from M. Ch. Naudin of the Villa Thuret, Antibes, France, where is a celebrated plantation of many species of Eucalyptus. I will refer to *E. viminalis* under that heading, and would observe that apart from the evidence yielded by the experiments on the kinos themselves, the *leucoxylon* trees must have been raised from seed of trees indigenous to Victoria or South Australia.

Following is their analysis :—

Eau hygroscopique	18·94
Sels fixes	1·32
Tannin et catéchine	74·95
Gomme	2·74
Débris cellulaires...	1·51
Perte	0·54
	100·00

The constituent in the above analysis worth noting is the gum. Obviously the conditions under which these trees grow favour the development of gum, as this substance, though always carefully looked for, is absent in turbid kinos obtained from Australian grown trees. In several species I have believed that I have found gum (never much more than a barely weighable quantity, however), but on more thorough examination the substance is found not to be precipitable by alcohol. Care must be taken to remove all catechins before the alcohol is added.

Eucalyptus cornuta, Labill. B.Fl. iii. 234.

No. 46. The "Yeit" or "Yate" of Western Australia. Specimen of kino received from Baron von Mueller, July, 1891.

General appearance, friability, and colour of powder normal. It does not entirely dissolve in cold water; it forms a dirty brown liquid, which does not settle readily. It does not entirely dissolve in alcohol, the supernatant liquid is clear and bright, but when agitated it forms a very turbid liquid of a dirty brown colour.

Its composition is as follows :—

Catechin and tannic acid	...	80·9
Ligneous matter, &c. ...	...	2·51
Moisture	...	15·72
Ash	...	·87
		100·00

Tannic acid determination (Lowenthal) 36·1 per cent. It was analysed August, 1891.

The following species, viz. :—

E. rostrata — *E. Maideni*
E. viminalis — *E. Gunnii*
E. Stuartiana — *E. goniocalyx*
and perhaps *E. Bäuerleni*

yield kinos possessing many points of resemblance, and are grouped together provisionally.

EUCALYPTUS ROSTRATA, Schlecht., B.Fl. iii. 240.

The well-known "Red Gum" of Victoria and the Murray and Edwards Rivers, N.S.W.

The kino of this species is perhaps the best known of all Eucalyptus kinos, chiefly through the enterprise of Mr. Joseph Bosisto, of Melbourne.

It is a useful astringent, and it seems to be increasing in favour with medical men in England, America, and Australia.

The official kino *(Pterocarpus)* contains, I believe, no substance which is not contained in this and some allied kinos, for which they appear to be a perfect substitute. See *Pharm. Journ.* [3], xx. 221, 321.

The kino of *E. rostrata* will be found mentioned in all modern works on Materia Medica. In Martindale and Westcott's *Extra Pharmacopœia*, for instance, we have the following :—"*E. rostrata* and *E. corymbosa*, and probably other species imported from Australia. It is semi-translucent and garnet-coloured, not so

dark as, but resembling kino in appearance, soluble in water, tough, difficult to powder [not correct as applied to these two kinos, J. H. M.], it adheres to the teeth when chewed, is intensely astringent to the mucous membrane, useful in diarrhœa, relaxed throats, and given with success to check the purging of mercurial pills."

But the following statements pertaining to the percentage of tannic acid, and the solubility, are somewhat misleading, since I have shown the enormous variation in the properties of kinos caused by age.

"Of 100 parts 90 are dissolved in cold water, the solution being clear. 27 parts of isinglass precipitate all the astringent matter." Squires' *Companion to the B.P.*

Dr. Wiesner says of a sample:—"Easily soluble in water and alcohol; solution neutral, free from gum-resin. Broken masses of a zircon-red, sometimes light brown, mixed with bits of dark."

47. "Red Gum;" purchased in Sydney, 22nd November, 1888. Of Victorian origin.

In lumps up to the size of peas, though angular. Prevailing colour purplish-brown. Is readily powdered between the fingers, forming an ochrey-brown powder. The mass of kino has not the brilliant appearance of the kinos of the ruby group, owing to this friability.

In cold water it dissolves fairly readily and almost entirely to a reddish-brown liquid.

Its composition (determined November, 1888) is:—

Catechin and tannic acid ...	84·3
Ligneous matter, &c.	·3
Moisture	15·2
Ash	·2
	100·00

Tannic acid determination (Löwenthal) 46·22 per cent.

No. 47. E. ROSTRATA, var. "Creek Gum," Tarella, Wilcannia, 23rd August, 1887. Diam., 1-2 feet. Height, 30-40 feet.

Only obtainable in rather small quantities, and in rather small pieces. Pale, as kinos go, very bright-looking, and of a ruby colour. Powders fairly readily, forming a powder of a light brown tint.

It dissolves almost immediately to a pale brownish or almost orange solution, leaving a sediment of a whitish salmon colour, with a few dark-coloured particles, like those of *E. goniocalyx*, only cleaner looking.

Its composition (determined October, 1888) is :—

Catechin and tannic acid ...	82·7
Ligneous matter, &c.	·6
Moisture	15·8
Ash	·9
	100·00

Tannic acid determination (Löwenthal) 47·746 per cent.

EUCALYPTUS VIMINALIS, Labill. (Syn. *E. fabrorum*, Schlecht.), B.Fl. iii. 239.

Dr. Wiesner says of two samples of kino belonging to this species : "*E. viminalis.* Only partly soluble in water, with light brown colour; contains a little gum-resin. Brittle, like kino. Add hydrochloric acid to the solution, then ammonia, a precipitate is obtained which blackens in the air."

"*E. fabrorum*, not readily soluble in water : solution yellowish, faintly acid, turbid on cooling; contains gum-resin. Particles dark black-red, slightly transparent shiny fracture"

The following statement occurs in the Report Intercol. Exhib., Melbourne, 1861 :—"The resin (*sic*) of *E. viminalis* in its decomposed state furnishes a real pigment."

No. 48. "Ribbony Gum," "Manna Gum." This is a variety with bluish, broad leaves. Quiedong, near N.S.W. : Victorian border, 26th March, 1887. Height, 60-80 feet. Diam., 3-4 feet.

In small fragments, prevailing colour reddish-brown of all depths of tint. Bright-looking. Easily reducible to a powder between the fingers. Colour of powder light orange-brown.

In cold water it forms a solution of an orange-yellow colour, something like linseed oil. Residue of a pale salmon colour, with a few dark particles. Of the strength of 1 grm. to 1 litre a beautiful clear solution of a dark amber colour is formed.

Its composition (determined October, 1888) is :—

Catechin and tannic acid	82·9
Ligneous matter, &c.	·8
Moisture	15·8
Ash	·5
	100·00

Tannic acid determination (Löwenthal) 31·99 per cent.

No. 49. A sample procured by me from Mt. Victoria, N.S.W., March, 1889, was perfectly fresh, and some of it was even treacly when collected, though like other kinos of this group it dries almost immediately. It is orange-brown of all tints, and very crumbly, new as it is. I have not sufficient for a complete investigation.

It was from a tree which may provisionally be known as the variety *multiflora* of this species.

Messrs. Heckel & Schlagdenhauffen (*op. cit.*, p. 151) have examined kinos of this species grown in the South of France.

Following is their analysis :—

Eau hygroscopique	7·083
Cendres	0·250
Tannin et catéchine	92·667
	100·000

on which they make the following remarks :—

"La quantité de tannin renfermée dans le kino d' *E. viminalis* est extraordinairement considérable, et semble en promettre un emploi industriel assuré."

Eucalyptus Stuartiana, F.v.M., B.Fl. iii. 243.

No. 50. The collector of this kino, Mr. W. Bäuerlen, states that when collecting it on the borders of Victoria and New

South Wales, some ladies, who saw him thus occupied, assured him that they knew of nothing which cleanses the teeth so quickly and so effectually as this kino. Its friability combined with its astringency have doubtless secured it this reputation as a dentifrice. *E. rostata* kino is similarly used on the Murray.

"Apple-tree," Quiedong, 24th April, 1887. Diam., 3-4 feet. Height, 80-100 feet.

This is a comparatively dull-looking kino, having somewhat the appearance of seed-lac, and the particles are equally variable in point of colour. Exceedingly brittle and forming a powder of a dull sienna-brown.

In twenty-four hours it completely disintegrates under water, forming two well-defined layers. The sediment is of an ochrey brown colour, while the supernatant liquid is of a dark reddish brown. The behaviour of this kino is very much the same as that of *E. viminalis*.

Its composition (determined October, 1888) is:—

Catechin and tannic acid	83·0
Ligneous matter, &c.	1·0
Moisture	15 3
Ash	·7
	100·00

Tannic acid determination (Löwenthal) 26·412 per cent.

EUCALYPTUS MAIDENI, F.v.M., in P.L.S.N.S.W. [2], iv. 1020.

"Blue Gum"; called also "White or Spotted Gum."

Until quite recently this tree had been only cursorily examined, it was for many years looked upon as *E. globulus*, and surprise was expressed that *E. globulus* had such a wide range in New South Wales. The Rev. Robert Collie found it several years ago between Braidwood and Araluen, announced it to be *E. globulus* (to which, indeed, it bears much resemblance), and this statement has been copied into several books. Had not such prominence been given to the statement, it would not now be

necessary to contradict it at such length. To be specific, *E. globulus* does *not* occur in the county of St. Vincent, or so far east; it is only here and there, and then sparsely, found on the N.S.W. side of the Murray. *E. Maideni* is a common tree on the mountains about Araluen, where it is called "Blue Gum." *E. globulus* has been specially looked for, during six seasons, from Shoalhaven to the Victorian border, but without success, and the specimens seen, referred to *E. globulus* by local people, all belong to the species named *E. Maideni* by Baron von Mueller.

No. 51. From Colombo, Candelo, N.S.W., "Blue Gum." Height, 80 to 120 feet. Diam., 2 to 5 feet.

This sample has a brighter appearance externally than the majority of kinos belonging to this group; it is of a dark sienna colour, powders readily between the fingers, the powder having an ochrey colour. Dissolves in water almost entirely to a dirty brown colour, the water remaining very turbid.

Its composition (determined August, 1891) is :—

Catechin and tannic acid ...	79·75
Ligneous matter, &c.	3·2
Moisture	15·77
Ash	1·28
	100·00

Tannic acid determination (Löwenthal) 25·5 per cent.

No. 52. "Blue Gum," from Bolaro Mountain, gathered Sept., 1890. Height of tree, 150 feet. Diam., 2 feet.

Resembles previous specimen in appearance.

EUCALYPTUS GUNNII, Hook., B.Fl. iii. 246.

No. 53. The kino examined is from a variety known as "Flooded or Bastard Gum," and was obtained from Delegate, near the Victorian border. Collected May, 1887. Height of trees, 60-80 feet. Diam., 2-3 feet.

Appearance and friability normal. Cold water yields a pale orange solution, leaving a quantity of sediment of a salmon colour, in which are interspersed a few dark coloured particles.

Its composition (determined October, 1888) is :—

Catechin and tannic acid ...	79·22
Ligneous matter, &c.	·78
Moisture	19·6
Ash	·4
	100·00

Tannic acid determination (Lowenthal) 34·032 per cent.

Eucalyptus goniocalyx, F.v.M., B.Fl. iii. 229.

Usually known as "Spotted Gum" in Victoria, but not to be confused with the common N.S.W. "Spotted Gum" (*E. maculata*)

No. 54. Specimen of kino from Bonang, near Delegate, where the tree is known as "Mountain Gum." Height of trees, 100-180 feet. Diam., 4-8 feet. Kino collected May, 1887.

This sample is the dullest looking of all the kinos examined, friability normal. It yields a brown powder. The general colour of the unground portion is purplish brown. The bulk of this sample is much older than that of the sample of *E. rostrata* (No. 47), but specimens taken from bulk cannot in any way be distinguished from it from outward appearances.

In cold water it forms a light reddish-brown turbid liquid, leaving a muddy-looking residue of a salmon colour; like most kinos of this group, it is exceedingly tedious to extract the last portions of soluble matter.

Following is its composition (from analysis made October, 1888) :—

Catechin and tannic acid ...	76·02
Ligneous matter, &c.	1·02
Moisture	22·1
Ash	·86
	100·00

Tannic acid determination (Löwenthal) 35·555 per cent.

EUCALYPTUS BAUERLENI, F.v.M. in Victorian Naturalist, October, 1890.

No. 55. This species is confined to South-eastern New South Wales. Sample of kino obtained from Sugar-loaf Mountain, Braidwood, N.S.W., September, 1890, from trees 40 feet high, with a diameter of 6 inches.

A fresh, bright-looking kino of a reddish-brown colour, friability and colour of powder normal. I have not sufficient kino, at present, to make a complete examination of it.

The kinos of the following species

E. punctata
E. longifolia

differ from each other, and appear to have no close affinities with any of the previously described kinos.

EUCALYPTUS PUNCTATA, DC.

No. 56. "Grey Gum" or "Leather-jacket." The Valley, Blue Mountains, N.S.W., 3rd April, 1888. Height, 80 feet. Diam., 3 feet.

This kino, especially when in large masses, somewhat resembles hepatic aloes in appearance, but it is far more brittle than that substance, crumbling without much difficulty by pressure of the fingers. Its colour may be described as of very dark brown, with a slight orange tint, and comparing it with still another substance, one from the mineral kingdom, it is much like the so-called melanite garnets from Franklin, New Jersey, U.S.A. The colour of this and many other gums, resins, &c., cannot be distinctively described without making a comparison with the tint of some well-known substance. The powder is of an ochre colour, slightly more brown than Oxford ochre.

When freshly gathered it has a vinous odour, somewhat similar to, but less powerful than that of the kino of *E. maculata.* I happened to tap quite a reservoir of 8 or 10lbs. of this kino, which

was as fluid as molasses at first, but on a few moments' exposure to the air it hardened, and became quite brittle.

In cold water the bottom layer of liquid is of a rich reddish-brown, the rest of the liquid becoming, by diffusion, of the colour of olive oil. Abundant sediment.

Following is the composition of this kino (analyses made October, 1888).

Catechin and tannic acid	81·3
Ligneous matter, &c.	·9
Moisture	17·6
Ash	·2
	100 00

Tannic acid determination (Lowenthal) 31·99 per cent.

No. 57. Cambewarra (Bangley Creek), 21st and 27th April, 1888. Height, 50-60 feet. Diam., 2-3 feet.

The collector of this specimen said, "the kino of this Eucalypt is very rare, and very seldom shows itself outside on the tree; it usually collects in blisters under the bark, and those blisters are mostly on the branches or high up on the stem." My own experience is that, while this is not a plentiful kino, one occasionally comes upon masses containing several pounds, by following a fissure in the bark, near the ground. The present sample has evidently remained long on the trees, and is therefore of a dull colour for the most part, but individual pieces are exactly described by the description already given of the preceding specimen.

No. 58. Bangley Creek, Cambewarra, May and June, 1888. The description of No. 57 will apply here.

Analysis of this kino (made October, 1888) gave:—

Catechin and tannic acid	81·8
Ligneous matter, &c.	·4
Moisture	17·5
Ash	·3
	100·00

Tannic acid determination (Lowenthal) 34·031 per cent.

EUCALYPTUS LONGIFOLIA, Link et Otto, B.Fl. iii. 226.

No. 59. Usually known as "Woolly Butt." "The timber often traversed by kino-sediments" (Mueller). Specimen of kino from Dromedary Mountain, Tilba Tilba, N.S.W., where it is locally known as "Peppermint." Collected 13th September, 1889. Height, 80-100 feet. Diam., 2 to 6 feet.

This kino is dull looking, and of a dark brown colour, it does not powder readily between the fingers, it has a very bright fracture.

It dissolves almost entirely in water, the liquid remaining very turbid. In alcohol the colour is lighter than in the majority of kinos of this group; the appearance of turbid kinos when dissolved in alcohol is, however, often so much alike, that it is sometimes difficult to point out any distinction in their behaviour in this solvent.

Analysis (made August, 1891) gives:—

Catechin and tannic acid ...	77·76
Ligneous matter, &c.	2·0
Moisture	19·83
Ash	·41
	100·00

Tannic acid determination (Löwenthal) 19·5 per cent.

"BLOODWOOD" PROVISIONAL SUB-GROUP.

including:—

E. cormybosa,
E. terminalis,
E. eximia,
E. clavigera,

E. tessellaris appears to connect this group with *E. maculata* and *E. microcorys*.

EUCALYPTUS CORYMBOSA, Smith, B.Fl. iii. 256.

"Bloodwood." This tree is perhaps as fortunate in its vernacular name as any of the Eucalypts. When freshly exuded, the kino has all the appearance of a stream of blood, and so freely

does it flow that sometimes the appearance of the ground at the foot of one of these trees is quite startling. It dries almost immediately, except in damp weather, becoming exceedingly brittle. When freshly exuded it has a distinct smell, which as far as I know, is characteristic, and soon recognised. It is something of a vinous odour. Much of the kino exuded becomes entangled in the scaly porous bark, but one frequently comes across quite a store of the substance through tapping the communication with a reservoir which has collected behind the bark, or between the concentric circles of the wood; the passage gets choked up with indurated kino, but picking off the substance often causes the stream to flow afresh.

Lindley (Vegetable Kingdom, p. 737), says, "*E. robusta* contains large cavities in its stem, between the annual concentric circles of wood, filled with a most beautiful red or rich vermilion coloured gum." This description can only apply to *E. corymbosa*, as the very fresh kino is of an exceedingly brilliant colour, approaching to vermilion, but with a tinge of purple in it. So bright is even the old kino, that I believe I can infallibly recognise the produce of this species by this colour test alone.

"That (kino) from a species called 'Blood-tree' is heated (*sic*) in sheds (*sic*) by the blacks of Lake Macquarie, New South Wales, and applied to external wounds to make them heal." (Curtis' *Bot. Mag.*, Vol. 69, 4036).

"This kino is chiefly obtained by wood-cutters, being found in a viscid state in flattened cavities in the wood, and soon becoming inspissated, hard and brittle. Minor quantities are procured in a liquid state by incising the bark of living trees, forming a treacly fluid yielding 35 per cent of solid kino on evaporation." (Lock, *Spon's Encyclopædia*). This 35 per cent. is absurdly small, as the kino inspissates immediately; 95 to 99 per cent. of solid kino would be better. I would also point out that the kino collected from the outside is usually the best, as that which settles in the cavities is frequently contaminated with ligneous matter in a fine state of division (the exuviæ of various larvæ), which reduces its solubility.

Staiger (Queensland Cat. Col. and Ind. Exh., 1886) says of a sample of this kino, "59·03 insoluble in water, 10·82 soluble in alcohol, leaving 48·21 per cent., which was mostly soluble in caustic soda. This insoluble substance was intensely black, and was partly derived from altered kino-tannin, and partly from other substances not yet thoroughly investigated."

Dr. Bancroft observes that, owing to the ready friability of this kino, it is very suitable for powders and pills. It is given in doses from 2 to 10 grains.

Dr. Wiesner (*loc. cit.*) says, "Of all samples received most readily soluble in water. Solution deep blood-red; smells distinctly like Bordeaux wine, slightly acid, turbid on cooling, free from gum-resin. Bright shining surface of fresh fracture of lumps. Colour deep red."

No. 60. Cambewarra, August, 1886. Diam., 3-4 feet. Height, 80-100 feet.

This sample is in irregular pieces as large as the fist. Before they have been bruised they have the appearance of a very pulverulent, purplish-red hæmatite (such, for instance, as is common in the Elba mines). To say that it resembles a low-grade dragon's blood also gives a very good idea of its appearance. It readily makes an impalpable powder of a Venetian red colour, soiling everything with which it comes into contact.

Bloodwood kino can be delivered in Sydney for about 3d. per lb., and there is no doubt that it is a cheap and efficient substitute for the lower grades of dragon's blood. Both the aqueous and alcoholic solutions (especially the latter) form good wood-stains. Experts will probably pronounce the colour to be too fiery, but it can be brought to the required tint by admixture with burnt sienna or vandyke brown.

This specimen was from a very old tree, and one nearly dead. It was not obtained by wounding the stem, but was found caked in large masses between the trunk and the bark.

With cold water it forms a rich garnet-coloured liquid at the bottom of the vessel if undisturbed. As diffusion proceeds, the

remainder of the liquid is of an amber colour; sediment of a very dark red, and powdery. Alcohol yields a very bright red liquid.

It was analysed October, 1888, with the following result:—

Catechin and tannic acid ...	68·42
Ligneous matter, &c.	16·38
Moisture	14·7
Ash	·5
	100·00

Tannic acid determination (Lowenthal) 45·714 per cent.

No. 61. The Valley, Springwood, Blue Mountains, N.S.W. 2nd April, 1888 Diam., 1 foot. Height, 50 feet.

This sample was also obtained from the concentric layers of a tree. When removed it was slightly plastic, and of a dark crimson colour, reminding one strikingly of a candied fruit jam. When fresh (and for some weeks afterwards) it had a vinous odour.

It behaves to cold water in the same manner as the preceding specimen, except that the colour is much brighter looking. Alcohol yields a very bright red liquid.

It was analysed October, 1888, with the following result:—

Catechin and tannic acid ...	63·18
Ligneous matter, &c.	20·12
Moisture	16·3
Ash	·4
	100·00

Tannic acid determination (Lowenthal) 36·053 per cent.

No. 62. The Valley, Blue Mountains, 3rd April, 1888.

This kino was an outward exudation. It is rich coloured, and so excessively brittle that the vessel containing it readily becomes coated with a fine powder. In large masses it is of a purplish-red colour, while the powder inclines strongly to Indian-red. The colour of this kino when freshly exuded had all the brilliancy already described, but it tones down somewhat on keeping.

With cold water the solution is the same as that of No. 60 as far as colour is concerned, but the sediment instead of being powdery, is of a gelatinous consistence, and may be drawn out into threads. Alcohol yields a bright red liquid.

It was analysed October, 1888, with the following result:—

Catechin and tannic acid ...	82·4
Ligneous matter	1·1
Moisture	16·1
Ash	·4
	100·00

Tannic acid determination (Löwenthal) 56·888 per cent.

EUCALYPTUS TERMINALIS, F.v.M., B.Fl. iii. 257.

No. 63. "Bloodwood" of the interior of N.S.W. Whittabranah, Tibooburra, N.S.W. 29th October, 1887. Height, 30-40 feet. Diam., 1-2 feet.

This tree is for the most part sparsely distributed, and then only on rivers and creeks; also very few trees exude kino, and then only in small quantity. This sample has quite freshly exuded. It is in very small fragments with attached bark. It is of a pale ruby colour, and very bright looking. It is readily reducible to a powder between the fingers. Colour of powder dark salmon. It has a slight vinous smell.

In cold water it yields a pale orange-brown liquid with a light brown sediment, in appearance much like (though lighter than) some specimens of *E. corymbosa* kino.

It was analysed August, 1891, with the following result:—

Catechin and tannic acid	85·3
Ligneous matter, &c.	1·3
Moisture	13·2
Ash	·2
	100·0

Tannic acid determination (Löwenthal), 63·5 per cent., the highest percentage obtained during these investigations.

EUCALYPTUS EXIMIA, Schauer, B.Fl. iii. 258.

No. 64. "Mountain or Yellow Bloodwood." The Valley, near Springwood, N.S.W.; collected April, 1888. Height of tree, 70-80 feet; diam., 1-2 feet.

This kino is bright looking, much resembling the better samples of *E. corymbosa* kino, but the colour of the powder at once distinguishes it from that kino, the powder of *E. eximia* being of a dark buff colour, slightly darker than the majority of kinos of this group. The soft friable nature of the bark of this tree makes the collection of the kino a matter of difficulty, and it appears never to exude abundantly. In water it does not wholly dissolve, the liquid on standing becomes quite clear and transparent and of an amber colour.

It was analysed August, 1891, with the following result:—

Catechin and tannic acid ...	84·41
Ligneous matter, &c.	3·2
Moisture	11·99
Ash	·4
	100·00

Tannic acid determination (Lowenthal), 47·5 per cent.

EUCALYPTUS CLAVIGERA, A. Cunn., B.Fl. iii. 250.

No. 65. Kino received November, 1889, from Baron von Mueller, who obtained it from Arnhem's Land, North Australia.

Bright looking, deep reddish-brown in colour. Friability and colour of powder normal.

In water it does not wholly dissolve, the catechin remaining as a yellow powder. On standing, the water becomes clear and transparent and of a bright amber colour.

Following is the analysis (made August, 1891) of this kino:—

Catechin and tannic acid ...	85·98
Ligneous matter, &c.	1·1
Moisture	12·63
Ash	·29
	100·00

Tannic acid determination (Löwenthal), 44 per cent.

EUCALYPTUS TESSELLARIS, Hook., B.Fl. iii. 251.

"Moreton Bay Ash." This kino has the property of exuding of a dark brown treacle colour, and soon becoming black without any tint of red. According to Mr. Staiger, quoted by Dr. Bancroft, it has a specific gravity of 1·35 and contains 71·7 per cent of matter soluble in boiling water, and on cooling the solution becomes turbid and deposits catechin. The portion insoluble in water is soluble in alcohol, and the residue, when treated with ether, leaves a dark coloured brittle mass identical with shellac, possessing the same qualities both technically and chemically,* and giving a good French polish of a rather darker colour than the usual commercial article. This shellac constitutes about one-fifth of the entire gum; it is insoluble in benzine, kerosene and the essential oils. The portion dissolved by ether forms a pliable, reddish, transparent mass, which does not become dry, even after four or five days.

No. 66. "Moreton Bay Ash." "Wonkara" of Pt. Curtis. Received from Mr. F. M. Bailey, Colonial Botanist, Queensland, 24th July, 1891.

This kino is of a reddish-brown colour, is easily powdered between the fingers, and the powder is of a light yellow colour. Its general appearance at once indicates the group to which it belongs. Its behaviour in water is much the same as that of *E. maculata*. It was analysed August, 1891, with the following result:—

* This is erroneous. The resin is not more than a trace (I can find none in my sample), but the catechin under some circumstances has a resinous appearance.

Catechin and tannic acid	82·1
Ligneous matter, &c.	2·1
Moisture	14·9
Ash	·9
	100 0

Tannic acid determination (Löwenthal), 55·5 per cent.

EUCALYPTUS MACULATA, Hook., B.Fl. iii. 258.

The "Spotted Gum" of New South Wales and Queensland.

I am only aware of the existence of two previous analyses of this kino, but they differ exceedingly, and in the absence of the fullest details of the kinos, one cannot institute comparisons between them.

According to Mr. Staiger (quoted in Dr. J. Bancroft's "Contributions to Pharmacy from Queensland"), "this kino is entirely soluble in boiling water to the extent of 60 per cent. It contains benzoic acid in an impure state, and catechin. The gum insoluble in water is of a sticky nature. When dissolved in alcohol, and the solution evaporated in the air without artificial aid, a sticky, clear, reddish brown, tasteless gum remained. If this is treated with ether, the sticky part of the gum goes into solution, and a dry, clear, reddish, tasteless gum remains possessing the qualities of shellac."

Mr. F. N. Grimwade (*Pharm. Journ.* [3], xvi., 1102) says of a sample, "Soluble in rectified spirit to the extent of 80 85 per cent.; cold water dissolved 18·9 per cent. Warm water extracted 'a slightly higher percentage.' The amount of volatile constituents was determined to be about 7·07 per cent., and consisted almost entirely of water, with the merest trace of a volatile oil, to which the peculiar aromatic odour, strongly resembling styrol, possessed by the gum, is due. By steam distilling 2 or 3 drops of this oil were obtained from about three-quarters of a pound of gum. 'I found no trace of either benzoic or cinnamic acids in the gum.'

"The tannic acid was found to be nearly allied to if not identical with querco-tannic acid, giving the blue-black precipitate

with ferric chloride, which is readily distinguished from the dirty green precipitate produced by kino-tannic acid, the variety existing in the B.P. kino. Percentage of tannic acid, 10 per cent."

Dr. Wiesner says, "*E. citriodora*,* Hook., easily soluble in water; solution faintly acid, smells like Bordeaux wine, yellow colour, turbid on cooling. Porous lumps with greenish lustre like Socrotine aloes; mixed with bark."

"*E. maculata*, Hook. Exactly like the last."

This is one of the kinos mentioned as quite suitable for replacing the official kino in *Spon's Encyc. of Industrial Arts.* It is, however, an unfortunate statement as regards this species, chiefly on account of its colour.

The kino from Cambewarra has quite a strong odour, something like decomposing apples or pears, or perhaps like a not perfectly sweet wine cask. But while the smell is hard to describe, it is easily recognised, and it appears to be characteristic.

That from New England has a smell similar to that which common resin gives out when held in the warm hand, while the other two samples have very faint aromatic odours. They all can be crushed between the fingers into a fine powder.

No. 67. Kino from Cambewarra, collected August, 1886. Height, 100-120 feet. Diam., 3-4 feet. Distinctly the darkest and most opaque looking of all the samples of this kino examined, with the exception of some fragments of No. 70. It is exceedingly brittle, even when in compact masses. The fracture is fairly bright, and shows a greasy lustre. Colour, olive-brown to reddish-brown. Forms a dull-looking powder of an olive-brown colour.

In cold water it forms a yellow solution of the tint of fresh and pure olive oil, leaving a resinoid catechin residue of a dirty brownish colour, very like soft toffee in appearance and with the odour already referred to. On long continued digestion with water it loses its resinoid texture and almost entirely dissolves.

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* Now considered to be a variety of *E. maculata*.

Water at 100° C (1 grm. to 1 litre) yields a browner solution than No. 68 and very turbid. Alcohol (to form tincture B.P. strength) yields an olive brown solution, with a dark olive-brown muddy residue, consisting largely of ligneous matter, and accompanied by a sticky substance. In ether a small percentage dissolves, and a lemon-yellow liquid is formed. The substance which gives the kino its odour is entirely taken up by the ether.

Following is an analysis, made October, 1888, of this kino:—

Catechin and tannic acid ...	84·25
Ligneous matter, &c.	1·95
Moisture	12·9
Ash	·9
	100·00

Tannic acid determination (Lowenthal) 46·222 per cent

No. 68. A specimen from New England, N.S.W., received 1886. A bright looking sample. It is third in depth of tint Is excessively brittle, and of a light olive-brown colour. Colour of powder light dirty yellowish-brown, inclining to raw sienna.

The description of the action of cold water on No. 69 applies to this one, with the exception that the difficultly soluble particles of this kino display less tendency to aggregate. The liquid is darker in colour, being about intermediate between Nos. 67 and 69. Continued treatment with water deprives it of its viscid nature, and almost entirely dissolves it. Water at 100° C (1 grm. to 1 litre) yields an amber-coloured liquid, slightly brown and slightly turbid.

It was analysed October, 1888, with the following result:—

Catechin and tannic acid ...	86·75
Ligneous matter, &c.	·4
Moisture	12·7
Ash	·15
	100·00

Tannic acid determination (Lowenthal) 51·809 per cent.

No. 69. Sample received from Mr. Charles Moore, Botanic Gardens, Sydney, 29th December, 1887.

This sample is the lightest in colour and most vesicular. Colour sienna-brown with a tinge of olive. Colour of powder raw sienna.

Cold water yields a solution of the tint of fresh and pure olive oil; the residue, of the colour and consistence of plastic sulphur, and adheres only very slightly to the vessel.

Treatment with hot water dissolves this substance rather readily, leaving a very small quantity of dirty yellowish-white powder. Water at 100° C (1 grm. to 1 litre) yields a very turbid liquid of a very light yellowish tint.

It was analysed October, 1888, with the following result:—

Catechin and tannic acid	84·9
Ligneous matter, &c.	·9
Moisture	14·0
Ash	·2
	100·00

Tannic acid determination (Löwenthal) 30·984 per cent.

No. 70. Sample received from Mr. F. M. Bailey, Colonial Botanist, Queensland, February, 1888.

Second in depth of tint, very like No. 67, but slightly lighter.

To cold water it yields a lemon-coloured solution rather paler than any of the others. To water at 100° C it yields a light brownish liquid, very turbid and very difficult to completely dissolve. Alcohol (B.P. tincture strength) yields a very dark olive-brown liquid.

It was analysed, October, 1888, with the following result:—

Catechin and tannic acid	81·3
Ligneous matter, &c.	2·0
Moisture	10·3
Ash	6·4
	100·00

Tannic acid determination (Löwenthal) 27·926 per cent.

No. 71. Kino from Nowra, gathered March, 1888. Height, 60-80 feet. Diam., 1-2 feet.

The trees yielding this sample had been recently ringbarked, and bush fires had recently passed through the locality. The flow of kino was copious. This sample is exceedingly like No. 69 as far as outward appearance goes, though its odour is as powerful as No. 67.

It is the most readily soluble in cold water of all the samples of this species examined, nevertheless it behaves much in the same way as No. 67. Water at 100° C (1 grm. to 1 litre) yields a perfectly clear bright amber-coloured liquid. Alcohol yields an olive-brown liquid.

It was analysed August, 1891, with the following result:—

Catechin and tannic acid	83·0
Ligneous matter, &c.	·2
Moisture	16·6
Ash	·2
	100·00

Tannic acid determination (Lowenthal) 53·5 per cent.

Eucalyptus microcorys, F. v. M., B. Fl. iii. 212.

No. 72. "The Tallow-wood" of New South Wales, called "Turpentine" in Queensland, but not to be confused with the New South Wales Turpentine *(Syncarpia)*. Sample of kino from New England, N.S.W., received 1886.

Kino of this species is less vesicular than that of *E. maculata*, but almost as readily reducible to a powder. This particular specimen is in small pieces, for the most part of the size of currants. In bulk it looks remarkably like a parcel of uncut garnets. Owing to its friability, the bright fractures become dulled with very little friction. Colour of powder orange-brown.

To cold water a yellow solution is yielded, with a slight tinge of brown, having a turbid residue of a dirty yellow colour with a

few black or dirty particles. Eventually almost everything dissolves, with the exception of a little accidental impurity.

It was analysed October, 1888, with the following result:—

Catechin and tannic acid	81·2
Resin	trace
Ligneous matter, &c.	·4
Moisture	18·1
Ash	·3
	100·0

Tannic acid determination (Löwenthal), 54·349 per cent.

No. 73. A sample from Uralba, Wardell, N.S.W., collected May, 1891, has also been examined. It is a new sample with no important differences from the foregoing.

It was analysed August, 1891, with the following result:—

Catechin and tannic acid ...	76·39
Resin	·8
Ligneous matter, &c.	·87
Moisture	20·4
Ash	1·54
	100·00

Tannic acid determination (Löwenthal), 50·45 per cent.

The presence of resin in a weighable quantity in this kino is worthy of notice.

No. 74. Two samples from Queensland, received from Mr. F. M. Bailey, F.L.S., Colonial Botanist.

The physical description of the preceding sample will apply here.

In cold water the layer at the bottom of the vessel becomes, if undisturbed, of the colour of treacle. The tint is precisely the same as that of a guaranteed sample of *Pterocarpus marsupium* kino received from India. It leaves a small quantity of a brown residue which produces turbidity if disturbed.

Water at 100° C. (1 grm. to 1 litre), yields a beautifully clear solution of the colour of colza oil. This remark applies also to the preceding sample.

It was analysed October, 1888, with the following result :—

Catechin and tannic acid	82·1
Resin	trace
Ligneous matter, &c.	·5
Moisture	17·2
Ash	·2
	100·0

Tannic acid determination (Löwenthal), 56·888 per cent.

Mr. Staiger says of a Queensland sample of this kino :—"The specific gravity is about 1·395, and the percentage of tannin 53·33. The solution in water when evaporated yields brownish scales."

Kinos not examined by me, yet, from the experiments of others, evidently falling in the Turbid Group.

EUCALYPTUS CALOPHYLLA, R. Br., B. Fl. iii 255.

"Red Gum" of Western Australia.

Dr. Wiesner says of this kino :—"Readily soluble in water; solution yellow, slightly acid, becomes turbid on cooling, free from gum resin. Irregular grains, light brown or red."

Baron von Mueller says :—"Kino-liquid of treacle consistence is obtained in considerable quantity by tapping the tree; it is caught in casks as material for tanning and dyeing purposes, and fetches from £20 to £25 per ton in the London market. This liquid indurates, and can, like the dry kino of this and other Eucalypts, be used also medicinally" *(Eucalyptographia)*. Soluble to the extent of 70·80 per cent. in cold water (Mueller).

This species is mainly alluded to in the following passages, but the remarks apply equally well to many other species.

"Botany Bay *(sic)* kino, the 'Red Gum' of Western Australia* *(Gummi rubrum)*, is the produce of several species of Eucalyptus (especially of *E. resinifera*,† Smith), which are widely distributed throughout the Australian continent.

"In physical characters and medical properties it is nearly allied to kino. It has been introduced into British practice by Sir Ronald Martin, who has found it very effectual in the treatment of chronic bowel complaints of invalids from India, but more especially in the chronic dysentery of Europeans. He regards it as less directly astringent, and more demulcent than catechin or kino. It has been highly reported of by several officers who have served in Western Australia, where the tree yielding it is abundant. . . . The drug possesses additional interest to the practitioner in India, from the fact that several species of Eucalyptus have become naturalised on the Neilgherries, and other high lands of India" (Waring, *Pharm. of India*).

This kino is probably alluded to in the following passage :—

"*Red Gum.*—A gum has been imported under this name from Western Australia, a specimen of which was laid on the table of the Pharmaceutical Society, 5th March, 1862. We call attention to this astringent gum as it is again being tried medicinally." *Pharm. Journ.* [2] iv. 40.

EUCALYPTUS GLOBULUS, Labill., B.Fl. iii. 225.

The "Blue Gum" of Victoria and Tasmania. This well known tree appears to be by no means an abundant yielder of kino. A sample sent to Dr. Wiesner, of Vienna, some time ago, is thus described by him :—"Readily soluble in water, solution pale reddish-yellow, slightly acid, very turbid on cooling; on heating becomes clear again. No gum-resin ; crumbling masses of light brownish colour." I have been unable to procure properly authenticated specimens of this kino.

* The "Red Gum" of Western Australia is peculiar to that colony and is *E. calophylla*.

† Incorrect ; see these Proc. ([2], IV. 1280), and also *Pharm. Journ.* ([3], XX. 221, 321).

EUCALYPTUS TRACHYPHLOIA, F.v.M., B.Fl. iii. 221.

Found in Queensland.

"The analysis of one sample of kino gave us as much as 73 per cent. of kino-tannic acid (soluble in water and alcohol and precipitable by acetate of lead out of an acidified solution), 18½ per cent. of kino red or allied substance (insoluble in water but soluble in alcohol), 8½ per cent. gum and pigment (soluble in water, and partly in alcohol, but not precipitable by acetate of lead)." (Mueller, *Eucalyptographia.*)

DESCRIPTIONS OF TWO NEW SPECIES OF *CARENUM* FROM WEST AUSTRALIA, WITH NOTES ON THE SYNONYMY AND DISTRIBUTION OF SOME PREVIOUSLY DESCRIBED SPECIES.

By Thomas G. Sloane.

In the following paper I describe two new species of *Carenum* from West Australia, which I have received from Mr. C. French of Melbourne as coming from between York and Yilgarn Goldfield. I also take the present opportunity to publish some information I have collected with regard to the synonymy and distribution of a few previously described species. I had hoped to have treated of the synonymy of the whole group of *Carenides* before long, but pressure of business and absence from Sydney have compelled me to relinquish the idea; and I now offer these notes merely as a contribution towards the elucidation of the synonymy of the group, which can only be undertaken in Sydney by a careful study of the Macleay Collection.

Carenum ignotus, n.sp.

Form elongate. Black, shining, (upper surface of head and prothorax dull in my specimen), elytra with a very narrow and faint edge of cærulean hue. Head subquadrate (4 × 4½ mm.), depressed; frontal sulci short, curved, not connected behind, almost parallel backwards, and extending forwards in full depth towards base of mandibles; preocular process prominent; eyes not prominent; two supra-orbital punctures on each side; antennæ moniliform, not tapering, last joint short and obtuse. Prothorax broader than long (5 × 6¼ mm.), smooth, subconvex, declivous behind; anterior angles rounded, not advanced; sides parallel in front of the

posterior angles, rounded at the posterior angles, obliquely narrowed behind them, and lightly sinuate before the base; base widely sublobate, truncate; marginal border narrow, not more prominent at posterior angles, thicker and more reflexed on the base; median line finely and distinctly marked; three marginal punctures on each side. Elytra oval (11 × 6¾ mm.), lævigate, subconvex; the disc depressed towards the base, slightly emarginate between the shoulders; sides lightly and evenly rounded, marginal border narrow; a row of equally placed punctures along the margin, and four punctures in a cluster on the base of each elytron near the humeral angle; two discoidal punctures on each elytron, one near the humeral angle, the other towards the apex. Prosternum smooth and strongly excavate between the coxæ. Anterior tibiæ bidentate; legs as in *C. scaritioides* and allied species.

Length 21, breadth 6¾ mm.

Hab. W.A. (between York and Yilgarn).

This species belongs to the same group as *C. scaritioides*, Westw., but it is a much flatter insect and differs in the shape of the prothorax, which is less shortly rounded behind the posterior angles and has the base truncate, sublobate, and more strongly margined than the sides. It seems nearly allied to *C. inconspicuum*, Blackb., which, however, from the description, has the prothorax with the anterior angles advanced, and the hinder part differently shaped from *C. ignotus*.

CARENUM HABILIS, n. sp.

Form short, broad. Shining, head black (a greenish tinge on sides of throat); prothorax deep purple-black with broad metallic green margin, undersurface greenish towards the sides; elytra purple-black (the purple tinge more conspicuous towards the sides) margined with green, inflexed margins green; abdomen and legs black. Head subquadrate, transverse (3½ × 5¼ mm.), smooth; frontal sulci curved, not connected behind, deep and almost parallel backwards, extending lightly forwards towards base of

mandibles; eyes not prominent; one supra-orbital puncture on each side; antennæ light, tapering. Prothorax short, transverse ($4 \times 7\frac{1}{4}$ mm.), smooth, subconvex; anterior angles broadly advanced; sides subparallel, a little rounded towards front, shortly rounded at posterior angles; base shortly lobate; marginal border broad on sides, reflexed, very strongly reflexed at posterior angles, thicker and less reflexed on basal lobe; median line lightly marked; two marginal punctures on each side. Elytra ovate (10×7 mm.), lævigate, convex; the suture deeply impressed; sides lightly and evenly rounded; base truncate; marginal border broad, reflexed; the marginal row of umbilical punctures evenly placed and strongly marked; each elytron with three punctures in a single row on base, and a discoidal puncture on apical third. Anterior tibiæ tridentate; inferior ridge strong; apical plate with a tooth projecting below the tarsi.

Length 20, breadth $7\frac{1}{4}$ mm.

Hab.—W.A. (between York and Yilgarn).

Of the species known to me this most resembles *C. dispar*, Macl.; but it differs conspicuously from that species in having the prothorax broader and less convex, and more strongly lobate, the elytra much less convex—especially towards the base—with the suture much more deeply impressed; the marginal border of both prothorax and elytra is broader.

The following notes contain information as to the synonymy and distribution of some species of the *Carenides* which I have accumulated during several years. I feel thoroughly satisfied of the correctness of all the synonyms given, but in any case where there may seem the least possibility of doubt I have stated such to be the case. To make the list of localities as useful as possible, while preserving conciseness and accuracy, I have added a key to their positions on the map. In all localities given without any authority being quoted I have myself collected specimens of the species referred to in such localities, and I have stated my authority in every case except where I am personally responsible for the locality.

Philoscaphus tuberculatus, Macl.

N.S.W.—Deniliquin, Mulwala, Narrandera, Condobolin, Coonabarabran, Nebea, Narrabri, Gragin: Q.—Finche's Creek.

Laccopterum loculosum, Newm. = *L. variolosum*, Macl.

A widespread species; very variable in size and appearance. I do not think *L. variolosum* can be maintained as a separate species.

N.S.W.—Murrumbidgee (Macleay), Forest Reefs (Lea), Mulwala: Victoria—Melbourne (Masters).

Carenum (Calliscapterus) campestre, Macl.

N.S.W.—Murrumbidgee (Macleay), Wilcannia District (Ellis), Liverpool Plains District (Peel), Mulwala, Nebea.

C. (Calliscapterus) odewahni, Casteln. = *C. ordinatum*, Macl.

S.A. (Castelnau, Macleay, &c.).

C. distinctum, Macl.

N.S.W.—Murrumbidgee (Macleay), Condobolin.

Carenum Bonellii, Brullé, = *C. viridipenne*, Westw. = *C. westwoodi*, Casteln. = *C. scitulum*, Macl.

I believe de Castelnau was right in regarding *C. viridipenne* as a synonym of *C. Bonellii*, and I consider his *C. westwoodi* in the same light. As regards *C. scitulum*, from examination of a type specimen in the Australian Museum I am convinced it is founded on what may be regarded as a mere "sport" of *C. Bonellii*,—specimens being occasionally found without the anterior discoidal punctures of the elytra. Of two specimens found by me at Springwood, Blue Mountains, one had the four punctures as usual, the other had the posterior punctures marked as decidedly as usual, but no trace of either of the anterior punctures, yet there could be no doubt both were the same species—*C. Bonellii.*

Victoria.—Lakes Entrance (Du Boulay); N.S.W.—Sydney (Lea), Mt. Kosciusko (Castelnau), Goulburn, Appin, Springwood.

C. brisbanense, Casteln. = *C. submetallicum*, Macl.

There is a specimen labelled *C. brisbanense* in the Australian Museum, and it is identical with *C. submetallicum*.

Q.—Brisbane (Howitt), Gayndah (Masters).

C. castelnaui, Chaud. = *C. occultum*, Macl.

A comparison of the type of *C. occultum* in the Australian Museum with de Chaudoir's description of *C. castelnaui* leaves no doubt in my mind they are the same species.

Q.—Gayndah (Masters), Wallangarra (Kershaw).

Carenum sexpunctatum, Macl.

I now regard this species (after examination of the type) as identical with *C. arenarium*, Sl. It is, however, founded on a mere "sport," and the name *sexpunctatum* is quite misleading, as the species has normally only four punctures on the elytra.

N.S.W.—Murrumbidgee (Macleay), Mulwala.

C. murrumbigense, Macl.

N.S.W.—Mt. Kosciusko (Helms), Mulwala, Narhadhan, Condobolin.

C. kingi, Macl.

N.S.W.—Goonoo Goonoo (King), Bathurst (Lea).

C. decorum, Sl.

N.S.W.—Tamworth (Musson), Coonabarabran, Nebea: Q.—Finche's Creek.

C. subcostatum, Macl.

N.S.W.—Clarence River (Macleay): Q.—Wallangarra (Kershaw).

Eutoma newmani, Casteln. = *E. punctulatum*, Macl.

These are evidently the same species.

Q.—Port Denison (Castelnau), Coomooboolaroo (Barnard).

Carenidium kreuslerœ, Macl. = *C. lacustre*, Macl.

After comparison of the type specimens of these species in Sir William Macleay's collection with several specimens in my collection from Mulwala, I regard them as identical.

S.A.—(Kreusler): N.S.W.—Wagga Wagga (Macleay), Mulwala.

Key to position of localities quoted.

New South Wales *(N.S.W.)*; *Appin* (township), about 50 miles S. from Sydney; *Condobolin* (town), Lachlan River, about 147 E. long.; *Coonabarabran* (town), Castlereagh River, about 149 E. long.; *Coonamble* (town), Castlereagh River, about 148 E. long; *Deniliquin* (town), Edwards River, 145 E. long.; *Forest Reefs*, western railway, a little E. from Orange; *Gragin* (station), 30 miles N.W. from Inverell, about 151 E. long.; *Goonoo Goonoo* (station), Peel River, near Tamworth, 151 E. long.; *Mulwala* (township), Murray River, 146 E. long.; *Narrandera* (town), Murrumbidgee River, about 147 E. long.; *Narkadhan* (station), half way between Murrumbidgee and Lachlan Rivers, 146 E. long.; *Nebea* (station), 18 miles N.E. from Coonamble; *Springwood* (town), western railway, 50 miles from Sydney; *Wingello* (railway station), between Sydney and Goulburn.

Queensland *(Q)*, *Coomooboolaroo* (station), west from Rockhampton, about 149 E. long.; Finche's Creek, a headwater of the Mooni River, about 40 miles S.W. from Dalby, Darling Downs District.

Victoria *(V.)*.

South Australia *(S.A.)*.

[redacted]

JOTTINGS FROM THE BIOLOGICAL LABORATORY OF SYDNEY UNIVERSITY.

By Professor William A. Haswell, M.A., D.Sc.

No. 15. On a Simple Method of substituting Strong Alcohol for a Watery Solution in the Preparation of Specimens.

Lo Bianco has in the last part of the "Mittheilungen aus der Zoologischen Station zu Neapel," published an account of the methods which he follows in preparing those marvellous specimens of marine invertebrates for which the Station has long been famous all over the world. Many of the methods described have now been known to zoologists for some time, *i.e.*, many of the methods of killing and fixing: it is more, perhaps, on account of the information which it gives us, as the result of a long series of trials, as to what re-agents are best adapted to each special group, with the best modes of application in each case, than as giving any entirely new formulæ, that the paper is of value.

As is well known, marine animals of different groups require to be dealt with in very different ways in order that we may preserve them in anything approaching to their natural form. Some may be taken by surprise, if we may use the expression, and killed so suddenly by some powerful poison that they remain fixed in a life-like shape. Others must be narcotised or paralysed by some such re-agent as chloroform, weak alcohol, or chloral hydrate, before the killing and fixing agent is used.

Whatever be the method of killing and fixing employed, there is in all delicate organisms a difficulty experienced in preventing

shrinkage during the later processes which the specimens have to undergo before reaching the strong alcohol stage. In the most admirably fixed specimens shrivelling will often appear when alcohol is applied. This difficulty is partly overcome, with great pains, by using a series of alcohols of ascending degrees of strength. But the result of this mode of procedure is not by any means always satisfactory.

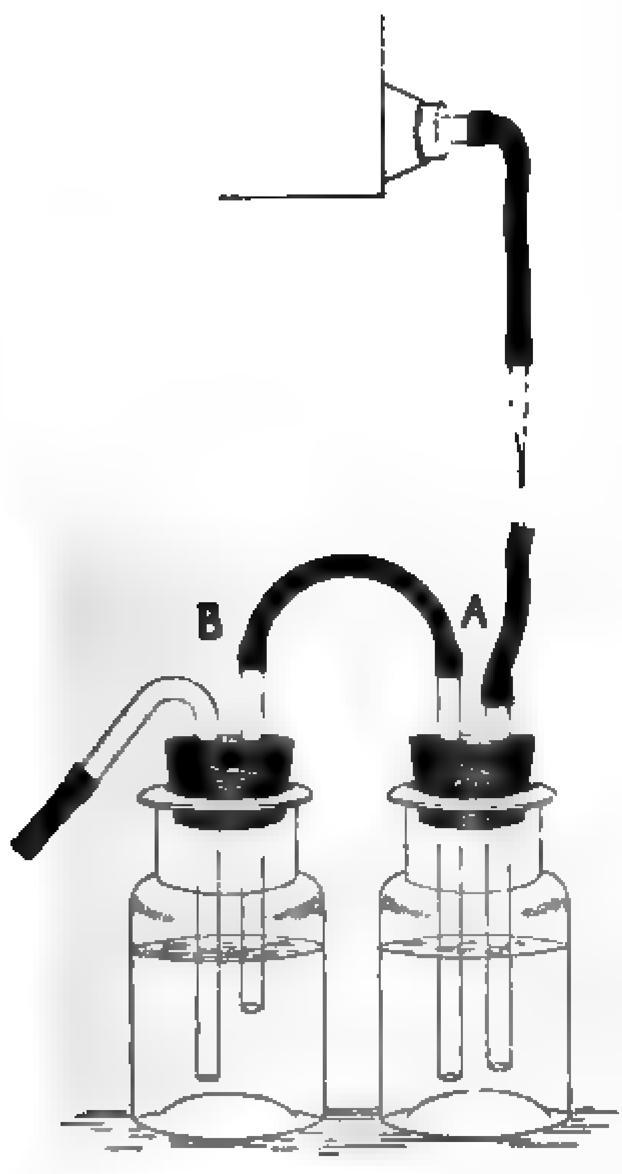
Dr. Cobb, in a paper read before this Society,* has described a method by which, in the case of small organisms, the shrinkage due to change from one fluid to another of a different density may be reduced to a minimum. In his differentiator we have an instrument of admirable simplicity for ensuring this result. But I have found that in practice the use of the differentiator involves a considerable expenditure of time. To get a specimen from distilled water to 90% alcohol for example, no fewer than eleven different mixtures of water and alcohol have to be made up and poured into the reservoir-tube.

A simple piece of apparatus which I have devised does away entirely with this—the gradual substitution for one another of the two fluids of different densities being effected automatically. An obvious mode of meeting the difficulty suggests itself at once. Why not have the second fluid falling into the first drop by drop, mixing thus very gradually with it and eventually replacing it? The difficulty in the way of this is that as each drop of the much lighter liquid enters the denser, violent though circumscribed currents are produced which are damaging to the delicate organisms we are dealing with.

The requisites for the method about to be described are—several reservoirs of glass or earthenware fitted with glass taps and having each a capacity of a gallon or more; some wide-mouthed bottles of a variety of sizes, fitted with perforated india-rubber stoppers, and some lengths of glass and india-rubber tubing.

* 'Proceedings,' Vol. v., p. 157.

Two bottles of similar size are connected together by tubing in the way represented in the woodcut. One of these, A, we call the mixing bottle; the other, B, contains the objects, and must have a capacity equal to *at least* a hundred times the bulk of the latter. The objects are in fluid 1, and it is desired to substitute fluid 2. Both bottles are filled, or partially filled, according to circumstances, with fluid 1, and bottle A is connected with a reservoir of fluid 2. It is somewhat difficult by means of a tap to regulate the flow so that, let us say, one drop in five seconds will pass out of the reservoir; and it is much more convenient to effect this by intercalating in the supply pipe a section of glass tubing drawn out to the required degree of fineness (represented in the figure as disconnected from the proximal portion of the supply tube). The rate of flow through this narrow section of the tube can be further regulated by raising or lowering the reservoir or the mixing bottle, thus altering the pressure. With bottle B is connected an over-flow tube. Above the narrow section of glass tubing in the supply pipe it is well to have a piece of filter paper stretched across the mouth of the piece of tubing in the form of a diaphragm, and held in place by the overlapping india-rubber tubing. This prevents the possibility of the narrow part of the tube being choked up by any minute particles



Fluid 2 thus enters into the mixing bottle at an extremely slow rate of flow, and becomes completely diffused, at first in extremely minute quantity, through fluid 1. The fluid from the mixing bottle is meanwhile entering bottle B at the same extremely slow rate, and it is obvious that with two fluids that readily mix, fluid 1 may be made to replace fluid 2 in bottle B with the required excessive slowness and regularity.

In the case of some of the liquids used in fixing and preserving, it is not necessary to use such a precaution as this. We may substitute saturated solution of corrosive sublimate for sea-water without the least risk of damage to the most delicate structures—the specific gravity of the two being very nearly the same.

Similarly distilled water may be at once substituted for osmic acid solution, or 1% chromic acid, or other fluid that does not differ at all widely from water in specific gravity. But with certain fluids the gradual substitution is necessary, and it is above all necessary in replacing water or a watery solution by alcohol, and this in the case of large specimens intended for museum purposes as well as smaller objects, can very conveniently be carried out by the simple apparatus I have described above.

Another method of effecting this substitution is the one devised by Schultze; and this seems to possess some decided advantages, at least for small objects. Schultze places the objects which he wishes to transfer from water to alcohol in a tube full of water, plugged at one end, and closed at the other by a diaphragm of chamois skin. The tube is placed in a vessel of alcohol and left there until by a process of diffusion through the diaphragm the water in the tube becomes completely replaced by alcohol. The same material being used for the diaphragm, the time which will be occupied before complete substitution takes place will vary with the capacity of the tube and the diameter of its orifice; and a series of experiments and calculations would have to be made before this method could be used with the assurance of good results. Should it be desired to have the specimens in absolute alcohol at the end of the process, some calcined sulphate of copper may be placed in the outer vessel.

RESIDUE OF THE EXTINCT BIRDS OF QUEENSLAND AS YET DETECTED.

By C. W. De Vis, M.A., Corr. Mem.

(Plates xxiii. and xxiv.)

Necrastur, n.g., Falconidæ.

Proximal end of a right humerus, wanting part of the radial tuberosity and distal portion of the pectoral crest (Pl. xxiv., fig. 1*a* and 1*b*).

The guide to the systematic neighbourhood of this fossil is discoverable in the seat of the insertion of the anterior coracoid ligament on the dorsal aspect of the radial tuberosity (fig. 1*a* *A*). In the great majority of birds the ligament occupies, and is inserted into, some part of a horizontal groove, which is variously modified in length, depth, width, straightness, and parallelism of its sides. In all these respects, singly or together, it may be studied in the *Psittaci*, *Strigidæ* (mostly), *Passeres* (mostly), *Coracidæ*, *Columbæ*, *Otididæ*, *Grallæ*, *Herodiones*, and *Anseres*. Occasionally it is reduced, as in the Rails, to two short converging walls enclosing a small pit close to the anterior edge of the bone, or to some such remnant of its full development in the *Psittaci*. In the minority it is merely a more or less irregular depression of variable depth and definition, affording on the whole so little aid to the investigator that by it alone he could hardly distinguish safely between the eagle and pelican. But happily it assumes in many of the *Falconidæ* a peculiarly distinctive form, one on which fancy bestows a certain crude resemblance to the footstep of a horse trotting on soft clay. This is best exemplified in *Haliaetus leucogaster*, wherein it may be observed as a subtriangular pit

of which the basal side slopes downwards with a transversely convex surface to a flat crescentic area embracing the rounded contour of its foot. In this form it occurs more or less obviously and symmetrically in *Haliastur*, *Nisaetus*, *Astur*, *Baza*, *Circus*, and *Lophoictinia*, and even in *Ninox* among the *Strigidæ*, but in no other birds has it been recognised by the writer. The apparent triviality of such a feature as this, though certainly diminished by its restriction to and frequency in one family, would hardly lead us to expect for it any great persistence in time, yet it is exhibited in the fossil in even greater precision than in *Haliaetus*. Whether then it be supported or otherwise by accompanying characters, it must hold its own and stamp the fossil with the seal of the *Falconidæ*. It does, however, derive sufficient countenance from the presence and position of a linear deltoid ridge on the ventral aspect of the bone; this, as usual in birds of prey, runs downwards parallel with and near to the midline of the shaft.

With guidance up to this point we have to be satisfied, for to no extant genus can we find direction in the rest of the fossil's structure. The head is narrow and remarkably prolonged upon the pectoral ridge, towards which it descends uninterruptedly without permitting the formation of an ulnar tuberosity (Pl. xxiv., fig. 1*b A*). If we take the humeral head of a *Menura*, lessen its curve and reduce the gibbosity of its ventral side, we shall reproduce that of the fossil on a smaller scale; and *Menura* alone appears to represent the extinct hawk in this particular. The form of the shaft is no less remarkable, and for its parallel we must resort to *Phalacrocorax*. It is eminently trihedral, presenting on its ventral aspect two faces, a flat anterior and a slightly convex posterior surface. These meet in a median culmen, and this again divaricates opposite the pneumatic foramen into two branches, the one merging into the strong ridge supporting, in the *Falconidæ*, the radial tuberosity; the other more subdued, but still distinct, as it is in no other bird, goes to the ventral edge of the head (Pl. xxiv., fig. 1*b B*). The sub-tuberous pneumatic foramen is small, round, and thick walled; the tunnel into which it opens proceeds uninterruptedly into the substance of the bone. Such are the generic

traits of our fossil. As before intimated, it shows a deltoid ridge running parallel with the culmen at a distance of two millims. on its posterior face (Pl. xxiv., fig. 1*b* *C*).

The strong differential characters of this humerus render it impossible to form any decided opinion as to the bird's relations with recent genera, but after much consideration the writer is inclined to think that on the whole it favours *Nisaetus*, the little crested eagle, more than any other. *Necrastur* was evidently a highly specialised member of its family, and if, from the extended surface of articulation, allowing a wider sweep of wing in the same plane, and from increased muscular room and superior leverage obtained on and from the prismatic form of the shaft, we may infer unusual faculties in flight, a word significant of these to some extent—*alacer*—may be allowed to stand as the second term of its name.

Distal end of an ulna—a bone having the characters of a falconine ulna and corresponding fairly in size with the preceding humerus may be placed with it until it can be shown to have belonged to a different hawk.

LOBIVANELLUS sp.

The remains of a very fragile distal end of a tarsometatarse attest the early existence of this genus. While still perfect the fossil was clearly identified generically, but before its specific characters could be ascertained, the cover of a book, inadvertently allowed to rest upon it, crushed it beyond the possibility of restoration for descriptive purposes.

TRIBONYX EFFLUXUS, n.s.

The bone figured [P.L.S.N.S.W. Vol. iii. (2), Pt. 3, pl. 35, fig. 9*b*] as the distal end of the humerus of a *Fulica (F. prior)* proves not to belong to that genus, but to *Tribonyx*. The error arose from an inadvertence for which no excuse can be offered—due attention was not given to the shape of the radial trochlea as it exists in the fossil and in *Tribonyx*, and undergoes change in *Fulica*. In *Fulica*, *Gallinula*, and *Porphyrio*, the antero-interior side of the trochlea is emarginated, and the emargination, aided by a slight

flexure outwards of the distal end, gives a perceptibly sigmoid shape to the whole. In *Tribonyx* the antero-interior side of the trochlea is entire, and its shape as a whole is a pretty regularly convex oval. From *T. mortieri* the fossil differs in the following points: the radial trochlea is shorter and makes with the long axis of the shaft a more oblique angle; the ectepicondylar tubercle is less tumid and there is consequently more space between it and the trochlea; the ulnar trochlea is broader at its junction with the inner condyle. In size the bird was about equal to *T. mortieri*.

Porphyrio mackintoshi, n.s.

Distal extremity of a right tarsometatarse (Pl. xxiv., fig. 2*a* and 2*b*). It is probable that this and *P. reperta*, m., will eventually be placed in a new genus, as in both the hind toe is less elevated than in the recent genus, and the inner trochlea (imperfect in the cotype of *P. reperta*) is found in the present fossil to be distinctly shorter, or rather not to extend so far distad as in *G. tenebrosa*—in fact, it fails distinctly to reach as far as the mesial trochlea instead of overlapping it. The present species differs from *P. reperta* in its greater size, showing, indeed, in this respect a superiority over the existing species, in a prolongation of the mesial trochlear surface nearly to the base of the process on its plantar aspect, and in the much larger size of the depression for the hind toe. It is dedicated to a gentleman who rendered most kindly aid to the collector, Mr. Hurst, during his search for fossils of this kind near Warwick.

Gallinula peralata, n.s.

The humeral index of the recent *G. tenebrosa* is 7·81, its tarso metatarsal index 7·94. The fossil metatarse, on which the species *G. strenuipes* was founded, has an index of 8·18, and, assuming approximately identical proportions in extinct and living species, the humeral index of *G. strenuipes* should be 8·03 or thereabouts. A humerus of a gallinule with an index so far raised as 9·18, as in the present fossil, cannot therefore be referred to *strenuipes* without forsaking a base of determination too useful to be quitted

needlessly. Little short of the discovery of a complete skeleton, a most unlikely event, would convince us that a wing so strong and a foot so comparatively weak as are indicated by the present humerus and the described metatarse co-existed in the same species of gallinule.

To difference of transverse proportions we must add no less decided difference in proportionate lengths. The humerus and metatarse of *G. tenebrosa* are equal in length, whereas the present humerus is shorter than the metatarse of *G. strenuipes* in the ratio 62·5 : 74·0. In brief, it is a fifth shorter and an eighth broader in the shaft than it should be were it derived from *G. strenuipes*.

Compared with the humerus of *G. tenebrosa*, the present bone has, apart from its still superior strength, two good specific characters—one of which consists in a more pronounced curvature of the shaft, the other in a more decided excavation of the antero-interior side of the palmar end of the radial trochlea (Pl. xxiv., fig. 3*b* *A*). In length the bone does not differ from the humerus of *G. tenebrosa*.

PALÆOPELARGUS, n.g., HERODIONES.

Distal end of a right "medius" metacarpal in conjunction with that of the "annularis" (Pl. xxiv., fig. 4*a* and 4*b*).

After tabulating the details of form and structure in the articulating surface of this bone in all available genera of birds, comparing the fossil therewith, repeating the process after a considerable interval of time and obtaining at the second trial the same result as before, the writer is led to regard his view of it as an approximation to the truth.

The following are the characters from which the status of the extinct bird is to be ascertained :—

Contour of the articulating surface oblong, elongate, narrow. Facette for the anterior and chief part of the proximal surface of the basal "medius" phalanx narrow and rounded (a form partly due to the abrasion of the edges) ; eminence for posterior concave part of the surface long, oblique, subcrescentic. End of fourth

metacarpal moderately produced beyond the level of the rest of the articulating surface, its facette for the fourth phalanx nearly flat, elevated, its base defined posteriorly by a pronounced depression of the metatarsal surface. Anterodorsal surface of shaft with the usual tendinal groove, which is well defined by ridges, posterior to it and near the edge of the articular surface a short ridge defining a second tendinal groove. Shaft compressed infero-superiorly.

The long quadrangular form of the articulation enables us to eliminate the families which do not agree with the fossil in those particulars—namely, the *Psittaci*, *Grallæ*, *Anseres*, *Ardeidæ*, and among the *Ciconidæ*, *Ciconia*, all of which, with some exceptions in a minor degree among the *Grallæ*, have also the fourth metacarpal not produced beyond the third, and the shaft subcylindrical or subtrihedral, except in *Esacus* and *Lobivanellus*, in which it is compressed. Of birds with an elongated articulation the Passeres have the third metacarpal excessively prolonged and the small articular eminence lenticular or more or less obsolete; it is much the same with the *Halcyonidæ* and *Pittidæ*. The *Falconidæ* have the third metacarpal somewhat prolonged, but the eminence is lenticular. The *Strigidæ*, with an oblique oval eminence, have the third metacarpal not at all prolonged, and almost the same may be said of the *Caprimulgidæ* and *Columbæ*.

The metacarpals most like the fossil bone are afforded by *Carphibis* and *Xenorhynchus*, and of these the latter approaches it most nearly in general form and size combined—*Carphibis* in the form of the articular eminence and presence of the short tendinal groove. But the difference in the extent to which the third metacarpal of the fossil is produced removes it widely from both these genera and compels one to propose for it the provisional genus named in the title. As the size of this part of the skeleton is somewhat considerably greater than it is in the Jabiru, the bird to which it belonged may be supposed to have been on the whole correspondingly larger, and if so, we may picture to ourselves a bird which may fairly be called *nobilis*.

Distal end of an ulna. This bone can only belong to the *Anseres* or to the *Herodiones*, and as it corresponds in size with the metacarpal preceding and does not protest against entering the same genus and species with it, such may be its domicile for the present.

PLATALEA SUBTENUIS, n.s. (Pl. xxiv., fig. 5*a* and 5*b*).

Proximal two-thirds of a right femur with the trochanter edges abraded. No subtrochanterian pneumatic foramen; two minute posterior foramina; trochanter narrow, continuous with extensor cruris ridge; space between trochanter and neck narrow; neck but slightly contracted; head but little expanded; shaft feebly curved, subcylindrical. After rejecting in our search for the living kindred of the bird now under scrutiny those femurs wherein the subtrochanterian foramen is present, the *Falconidæ*, *Gouridæ*, *Otididæ*, *Xenorhynchus*, &c., also those of the Passeres which possess a large posterior foramen, we find our means of discrimination almost restricted to the contour of the proximal surface of the bone and the relative position of the extensor cruris ridge. Those bird femurs, which on a fore end view are separable from the rest on account of the surface being in the first place subelongate, and in the next neither approximately hour-glass shaped nor considerably narrower immediately behind the head, in other words, devoid of a sudden contraction at any point in the trochanterian region, which are at the same time nearly straight in the proximal half of the shaft, and are comparable with the fossil in size, are to be found among the ibises and spoonbills, and not elsewhere. We may therefore conclude with some confidence that our fossil is derived from the *Plataleidæ*. But beyond this progress becomes hazardous, the fact being that the femurs of *Platalea* and *Carphibis*, indistinguishable generically from the fossil, are equally so one from another. Were they not from living birds, they would indeed be attributed to the same species of the same genus, a state of things, by the way, issuing a caution against hasty identification of fossil with recent bones of this class; yet, as the chances are very great against so close an approximation

of structural form occurring in a third genus, the fossil must be assumed to belong to one or other of the genera named, and as the spoonbills show greater fixity of type than the plurigeneric ibises, the judgment is fain to follow even so dubious a clue to freedom from perplexity. The specific differences from *P. regia* and *P. flavipes* observable in the fossil are a greater flattening of the proximal end of the shaft on its posterior surface and a diminution of the transverse axis of its distal moiety, resulting in a more cylindrical but more slender form.

Two distal moieties of the tibia, with all the characteristics of that bone in *Platalea*, but with size and proportions in accord with the femur above described, may be referred to it with some confidence that they belong to the same species. They at least prove the existence of a spoonbill among the other birds of the period, and thereby tend to confirm the accuracy of the preceding determination.

PELICANUS PROAVUS, n.s. (Pl. xxiv., fig. 6*a* and 6*b*).

The small pelican for which a name is proposed reveals itself in a left tarsometatarsal, of which the inner trochlea is mutilated, but sufficiently perfect to show that it was distinctly longer than the outer. By this character it is separated from all those birds which have the lateral trochleæ approximately equal in length, as well as from those in which the outer is very evidently the longer, and is associated with the birds of prey, diurnal and nocturnal, kingfishers *(Dacelo)*, *Menura*, *Pitta*, *Podargus*, *Herodiones*, *Pelicanus*, darters, and grebes, and doubtless others. Its trochleæ are not disposed nearly on the same plane, nor would a section of its shaft be either crescentic or planoconvex in shape; it is therefore foreign to the *Falconidæ*, *Strigidæ*, *Menura*, and the *Megapodes*. Its distal expansion is gradual and subelongate, very different to that of the *Herodiones*, which also have nearly co-equal trochleæ. With the bone in the kingfishers, nightjars, pittas, and grebes it cannot be compared. In *Pelicanus*, however, we find a complete reproduction of the structural features of the fossil, displayed in the same elongated pulley of the mid-trochlea, reaching with

rapidly converging edges to the plantar surface, in the large elongately oval foramen opening on the plantar surface in a hollow formed by the convergent roots of the lateral trochleæ, and on the dorsal surface at the end of a long deep sulcus in the body of the shaft, in the large depression for the first metatarse at the root of the inner trochlea, in the shape of the shaft in section, in the sharp narrow ridge descending upon the middle of the plantar aspect of the shaft and diverging outwards to the proximal end of the outer trochlea, and finally, in the faint groove impressed by the internal digital branch of the tibial artery, commencing at the dorsal end of the foramen and winding inwards and downwards to the interval between the middle and inner trochleæ. In recent Australian pelicans the groove is sometimes faint, and its presence seems to be a rare peculiarity among birds in general.

The width of the trochlear expansion in the fossil is 16·5 mm.; in *P. conspicillatus* it is, between the same points, 20 mm.; the length distad from the proximal end of the hallucal depression is 26·5 mm., against 32·3 in the recent bird. In proportions the two are therefore nearly identical, but in size the living species exceeds the extinct by one-fourth of the latter.

Though it may fairly be doubted whether difference of size, even though accompanied by somewhat brighter or duller tints, as in our pittas and megaloprepias, is a sufficient mark of specific distinction between existing birds, it can hardly be refused distinctive value in the present case.

Proximal end of a metacarpal, with a large pneumatic foramen placed as in *Pelicanus;* the bone is too much crushed and distorted to allow of a description of any value.

Dromaius gracilipes, n.s. (Pl. xxiii., fig. 7*a* and 7*b*).

Though desire for more ample knowledge of the bird-life of the past naturally seeks indulgence in the cognition of new kinds, it may be content if the rare objects it delights in serve only to confirm previous interpretations and yield further elucidation of

structure. This ground of satisfaction the rocks vouchsafe in the case of the extinct emu *Dromaius patricius*. Since certain of its remains were brought under notice* the following additional parts of its skeleton have been discovered:—A part of the distal end of a femur, the proximal third of a tarsometatarse, the calcaneal region of another metatarse, and the distal end of a third example of that bone. It was inferred from the remains then described that *D. patricius* possessed a proportionately shorter and stronger leg than the living species *D. novæ-hollandiæ*, and under the guidance of this conception, the distal extremity of a metatarse, which was observed to be even smaller and slimmer than that of the recent bird, was necessarily excluded from the bones referred to *D. patricius*, and the hope was entertained that sooner or later a fossil would be forthcoming to declare the exclusion justifiable. By good hap the expectation has been promptly realised. The true distal end of the metatarse of *D. patricius* proves to be conformable with the rest of the limb, and consequently the discarded fossil must be taken as presumptive evidence of the existence of a distinct species. Apart from size and proportions it is distinguished by a negative character peculiar to itself. It is well known that in the common emu, as in most birds, the main tibiometatarsal artery before reaching the trochlear expansion gives off a large branch—the plantar artery,—which, in order to reach the sole of the foot, passes through the bone between the bases of the middle and external trochlear processes by a perforation, which is the sole remnant of the original tripartite separation of the metatarsals. In the emu this perforation opens, not on the surface of the bone, but on the bottom of an oblong depression or pit, of which its oval aperture occupies more than the proximal half. Through the substance of the bone which forms the distal limit of the depression a second tunnel is driven longitudinally and opens upon the surface between the two trochleæ. The foramen of the anteroposterior or plantar canal is large—4·5 x 1·5 mm.—and its proximal end is 13.5 mm. from the intertrochlear surface.

* P L.S.N S.W. Vol. iii. (2), pt. 3, p. 1290.

In *D. patricius* the plantar perforation is exceedingly small, not greater than the diameter of an ordinary pin, and this is situated close to the edge of the intertrochlear surface; the descending digital division of the artery passes along a deep canaliculate groove not roofed in by bone. *D. patricius* presents a middle term as to this point of structure between the living emu and the bird represented by the fossil under notice, for in the last there exists no trace whatever either of the plantar canal or of tunnel or groove for the descending branch of the artery. Possibly the bird should on this account be generically distinguished from *Dromaius*, but its separation, before we are better acquainted with it, would hardly be prudent. Unfortunately, the fossil is in a very imperfect condition; the outer trochlea is broken off close to the shaft, of the inner trochlea there only remains a portion, and the lateral ridges of the mesial trochlea are abraded. In addition to the absence of the arterial canal, inferior size, a sensible anteroposterior compression of the shaft, and a disproportionate length and tenuity of the mesial trochlea are the features which chiefly differentiate the fossil from the bone of the recent bird. The last two characters suggest the name *gracilipes* for the species. From the table of measurements appended it will be seen that in *D. patricius* this part of the leg was larger in almost all its dimensions than it is in the living species. The exceptional agreement which obtains in the width of the mesial trochlea, showing relative narrowness of that part, is a specific character; so also is the comparatively parallel direction of the lateral ridges of this trochlea, as they run proximad on the anterior aspect of the bone, maintaining the breadth of the pulley nearly to the junction of the process with the shaft. On the other hand, the measurements of *D. gracilipes* are all less than those of *D. novæ-hollandiæ*, with the exception of that of the body of the mesial trochlea; taken from centre to centre of the lateral depressions, this width is as much greater as the thickness of the shaft is less. As far as we can judge from this fragment, *D. gracilipes* was not only inferior in size to the living bird, but, on the whole, was more attenuated in the proportions of its limb.

The most interesting feature in its foot is the disproportionate size of the middle toe: this, together with the absence of the arterial perforation, seems to prepare the way for the following bird.

Measurements.

	D. patricius.		*D. novæ-hollandiæ.*		*D. gracilipes.*
Trochlear expansion, palmar aspect over all..................	54·5	...	50	...	
Width of shaft in a line corresponding to proximal end of plantar foramen in living species	40	...	36·5	...	34
Length of mesial trochlea, anterior aspect.....	36	...	31	..	28·5
Length from transverse line of measurement to end of mesial trochlea........................	37	...	36	...	33·5
Thickness of shaft at middle of transverse line.................	16·5	...	13	..	11·5
Width of mesial trochlea, over all..............................	26·5	...	26	...	
Width of same between centres of lateral depressions	15	...	11	...	12·5

Fam. APTERYGIDÆ. gen. et sp. nov.

From among several hundred specimens forming an amateur's hoard of Nototherian fossils, lately added to those in the writer's charge, three only appertained to the birds of that age. One of these at once admitted itself to be a fragment from the foot of the emu *D. patricius*, in another was detected a duplicate of the type example of the mound-builder *Chosornis*, the third came with so peculiar a facies as to baffle recollection and inflame curiosity. A distal half or somewhat less of a tarso-metatarsus, it was immediately confronted with each one of a hundred metatarsals supplied by the chief types of the Australian birds now existing, and, failing

to fraternize with any of them, was reluctantly laid aside in favour of less reserved candidates for examination. In an idle moment some weeks later it chanced that the corresponding bone of a young *Apteryx*, *A. mantelli*, was taken in hand, and to his surprise the observer found himself at last in the presence of the more salient features of the fossil. As may be imagined, the two bones were quickly laid side by side and discussed. Whether the result of the comparison be a legitimate conclusion from the premisses or not it is for others to consider, for the future to decide. It can only be pleaded by the way that while "expectant attention" had no part in the recognition of the bone, the just demands upon observant attention made by so significant a fossil have been admitted and honoured.

From the accompanying figures of this bone (Pl. xxiii., fig. 8*a* and 8*b*) it will be seen that its most striking feature is the extension distad of what may be called the pedicels of its trochleæ, that is of the metatarsal elements after their release from confluence in the shaft, the trochlear surfaces not included. In contrast with those of all other birds examined, the trochleæ almost appear to be borne on the ends of moderately long stalks. In carinate birds the existence of a pedicel so defined is hardly recognizable on the dorsal side of even the mesial trochlea, and on the plantar surface, which is usually less invaded by an extension of the groove of the pulley, the length of the pedicel is seldom if ever greater than its breadth at the base. The statement is warranted by certain *Anseres* (*Chenopis*, *Biziura*) which have the longest pedicels observed. Still shorter of course are the bases of the lateral trochleæ in the *Carinatæ*. Among the *Ratitæ* the only genus possessing pedicels which are conspicuously elongated and of equal length on both surfaces is, so far as the writer's experience extends, *Apteryx*. But the characterization imparted by their unusual length is exactly that which was antedated in greater force in the fossil, while there is also exhibited by the extinct bone a like equality in the length of the opposed surfaces of the lateral pedicels. It may be thought that this greater freedom of the distal ends of the bone is probably the ordinary condition of immaturity. To meet

this very obvious objection, young metatarsals have been procured from a considerable number of birds of different families, all of which show confluence of the metatarsal elements to the same extent distad as in adults.

Associated with lengthened pedicels we see both in the *Apteryx* and in the fossil bird approximate equality in length attained by the lateral trochlear processes in their entirety, and, furthermore, an extension of the mesial trochlea almost entirely beyond the extremities of the other two. Greater weight will attach to a deduction from this composite character if one of the antecedents be expressed in the words of Owen, who, pointing out (Comp. Anat. of Vert. Vol. ii., p. 81) the leading differentiations of the metatarse in birds, says, "In the *Apteryx* and tridactyle cursores the mid-trochlea is the largest and extends by almost its whole length beyond the other two, which are nearly on a level." It is only necessary to add that the degree of extension of one lateral trochlea beyond the other is, allowing for difference of total dimensions, appreciably the same in the *Apteryx* and in the fossil.

In the absence of any feature proper to the *Carinatæ*, it would seem justifiable on the grounds already advanced to admit the extinct bird to a place in the apterygine division of the *Ratitæ*. But by way of fortifying the position taken up, it may be observed that there are other characters which, though less weighty, tend to confirm it. The distal end of the shaft in *Apteryx* is anteroposteriorly compressed and, in consequence of the divergence of the lateral pedicels commencing higher up the shaft than in other birds, laterally expanded. A glance at the figure (Pl. xxiii., figs. 8*a* and 8*b*), will show that the form of the shaft and the cause of its lateral expansion alike pre-existed in the fossil even more pronouncedly than in the living bird.

Again, in the whole number of recent metatarsals examined for the purpose, there is but one which shows on the surfaces of the shaft traces of embryonal conditions in the presence of lines of junction between its coalesced segments. As it is within the limits of possibility that none of these bones were derived from young birds, the immature metatarsals previously mentioned were

examined for the lines of coalescence; uncertain indications of them appeared in a few, but in none were they continuous and well marked. In the bone from the foot of an example of *A. mantelli* which seemed to be nearly half grown, these lines are still apparent in the form of fine continuous grooves. At maturity they disappear altogether, as I learn from Professor Parker, who kindly examined for me his adult specimens and found complete anchylosis to have taken place in all. In the fossil metatarsal these lines are on the posterior side quite conspicuous, but, as in the kiwi, they are less distinct on the anterior, and, again as in the kiwi, they are interrupted in the middle of that side by complete confluence of the superficies. The fossil obviously came from a bird of nearly the same age as the *Apteryx* compared with it.

In the figure of the metatarsal of the *Apteryx* (Pl. xxiii., fig. 9*a*) there is shown on the dorsal side adjoining the trochleæ of the inner and mesial pedicels a large rough depression for the insertion of their extensor tendons. Among other living birds areas of insertion as great and definite as these have hitherto eluded the search of the observer. On the exterior pedicel of the fossil the same feature is seen to occur (Pl. xxiii., fig. 8*a*).

Finally, as in the example of *A. mantelli* before us, the shaft is not pierced by the tibial artery. But this character is of comparatively little value since the perforation is, as we have seen, absent in a bird which either belongs or is nearly related to *Dromaius*, and is present in Eyton's figure of the metatarse of *Apteryx australis*.

The features which have been noticed so far are those in which the fossil appears to be in close agreement with *Apteryx*. United they seem to justify the conclusion that in spite of all our preconceptions this Australian relic represents a bird having a decided family relationship with the *Apterygidæ* of New Zealand.

But even so it was not an *Apteryx*—this it asserts emphatically.

In the first place it had no traceable hind toe. The portion of the shaft preserved extends proximad far beyond the level of this toe in *Apteryx* and bears on its surface no sign of, not the slightest depression on its rotundity indicating, the existence of a hallucal

metatarsal. In the immature *A. mantelli* the impression of the first metatarsal on the shaft is distinct, but considering that possibly it might be absent occasionally in this or other species the writer sought instruction from Professor Parker on this point also, and was very kindly informed by him that the impression is sometimes "nearly obsolete" in the living birds. As it appears from this that it is never entirely absent, we are at liberty to assume that the extinct bird was tridactyle, or, if we prefer it, had a hind toe in a still more rudimentary condition than *Apteryx*.

The elongation of the lateral pedicels, and especially that of the inner one, is carried to a considerably greater extent than in *Apteryx*, while their angles of divergence from the mesial pedicel are less.

More notable still as an index to the aptitudes of the bird, and tending moreover to explain the probable absence of the hind toe, is the size of the mesial pedicel, which is enlarged out of all proportion to the laterals. It is twice as broad as the inner, and two and a half times the breadth of the outer. Its trochlea evidently supported a toe which took a principal part in sustaining the weight of the body and was the main instrument of progression. It is therefore a fair inference that the cursorial power of the bird was much superior to that of the kiwis, and indeed it is scarcely too much to infer that in this important part of its organization the extinct bird was nearly as much an emu as an *Apteryx*.

Unconformably to the emu and kiwi alike is the inner trochlea with its pedicel, which in the fossil bird is or appears to be the longer of the two laterals—it is at least that trochlea which is on the thinner side of the shaft, the inner in *Apteryx*, which has the broader and more rhomboidal articulating surface, and which has the insertion of an extensor tendon stamped upon its pedicel.

The shaft, as before stated, is not perforated by the tibial artery, and herein agrees with the metatarsal of *A. mantelli* collated with it; but in the latter the artery in its passage between the outer and mesial pedicels is protected by a bony canal, almost amounting to a tunnel, developed in the angle formed by the pedicels; of this there is no trace in the fossil.

The magnitude of the middle toe, the superior length of the inner one of the laterals, the rudimentary state or complete absence of the hind toe are generic characters irreconcilable with *Apteryx*.

In stature the bird seems not to have exceeded the modern kiwis.

Dimensions.

	Fossil.		*A. mantelli.*
Length distad from termination of calcaneal groove	51·3	...	35·5
Trochlear expansion, over all	33·0	...	21·7
Breadth of shaft at point of fracture in fossil	12·0	...	7·0
Thickness at same point	8·3	...	5·0

If after forming its estimate of the intrinsic probabilities of the case the judgment can pronounce in favour of the view that the extinct bird stood well within the pale of the *Apterygidæ* while yet maintaining relations with the three-toed *Ratitæ* the name *Metapteryx bifrons* may seem somewhat appropriate, and provisionally this name is suggested.

Arrived at this goal without bias we may now permit ourselves to remember that the present is not the first intimation we have received of generic relations existing between the Australian and New Zealand struthiones. *Dromornis* is in great part a *Dinornis*, *Dinornis* itself has occurred in Queensland. These fossils and the present mutually support and illustrate each other. *Dinornithidæ* and *Apterygidæ* now conspire to establish the fact that Australia was the cradle of the birds whose latest phase of existence in a distant island will soon be but a tale told over a few bones.

The collection of fossils which has from time to time afforded tantalizing glimpses of the bird realm of an earlier Australia, a realm doubtless no less populous than in the present, much more so if the ratio of bird to beast obtained then as now, after disclosing less than the twentieth part of the number of existing land and fresh water birds, ceases to supply information.

Numerous bones, indeed, remain unnoticed, but they are heads of fibulas, phalanges of toes, fragments of ribs, waterworn relics of sterna, all barren of instruction. An opportunity, therefore, fairly offers of summing up the knowledge we seem to have acquired from the collection in this its initial stage; and if the great slowness with which bird fossils are brought together be considered we shall have less difficulty in accepting the offer; judging from past experience, it is not probable that a supplement to the following list will be necessary for some years, however soon a revision of its contents may be so judged by a succeeding observer.

LIST OF BIRDS

(From the so-called Post Pliocene Drifts of Queensland).

N.B.—For all names without authority stated the writer is responsible, extinct genera in italics.

CARINATÆ.

FALCONIDÆ.

Taphaetus brachialis, syn. *Uroaetus brachialis*.
Necrastur alacer

COLUMBÆ.

Lithophaps ulnaris.
Progura gallinacea.

MEGAPODIDÆ.

Chosornis præteritus

GRALLÆ.

Tribonyx effluxus, syn. *Fulica prior* (part)
Porphyrio (?) reperta.
Porphyrio (?) mackintoshi.
Fulica prior.
Gallinula strenuipes.
Gallinula peralata.
Lobivanellus sp.

[redacted]

CARINATÆ (*continued*)—

Otididæ, gen. et sp. ind.

Anseres.

Anas elapsa.
Dendrocygna validipennis.
Biziura exhumata.
Nyroca robusta.
Nyroca sp.

Herodiones.

Xenorhynchus nanus.
Palæopelargus nobilis.
Platalea (?) subtenuis.

Steganopodes.

Pelicanus proavus.
Plotus parvus.

RATITÆ.

Casuaridæ.

Dromaius patricius.
Dromaius gracilipes.

Dinornithidæ.

Dromornis australis, Owen.
Dinornis queenslandiæ.

Apterygidæ.

Metapteryx bifrons.

The whole of the twenty-eight species indicated and seven, or more probably eight, out of the twenty-four genera to which they are referred, are extinct. The extent of the change which the Nototherian avifauna of Queensland is thus shown to have undergone is very much the same as that observed in the case of the marsupials. With two or three *very doubtful* exceptions all these have submitted to specific metamorphosis, and of twenty-six of the old genera but fourteen survive. Has the change been rapid?

then from what cause? Not from the advent of man; savages do not exterminate. Have we hitherto considered this fauna younger than it really was? possibly, but for the solution of these questions we must look to further accumulation and study of palæontogical evidence. So far as the writer can see at present the Age of the fauna preserved in the Darling Downs deposits cannot well be later than Early Pliocene.

EXPLANATION OF PLATES

PLATE XXIV.

Fig. 1a.—*Necrastur alacer* proximal end of right humerus; outer aspect.

Fig. 1b.—*Necrastur alacer* proximal end of right humerus; inner aspect.

Fig. 2a.—*Porphyrio mackintoshi* distal extremity of a right tarsometatarse; posterior side.

Fig. 2b.—*Porphyrio mackintoshi* distal extremity of a right tarsometatarse; anterior side.

Fig. 3a.—*Gallinula peralata* humerus; outer aspect.

Fig. 3b.—*Gallinula peralata* humerus; inner aspect.

Fig. 4a.—*Palæopelargus nobilis* distal end of a right "medius" metacarpal.

Fig. 4b.—*Palæopelargus nobilis* distal end of a right "medius" metacarpal.

Fig. 5a.—*Platalea subtenuis* proximal end of right femur; inner aspect.

Fig. 5b.—*Platalea subtenuis* proximal end of right femur; outer aspect.

Fig. 6a.—*Pelecanus proavus* left tarsometatarsal; posterior side.

Fig. 6b.—*Pelecanus proavus* left tarsometatarsal; anterior side.

PLATE XXIII.

Fig. 7a.—*Dromaius gracilipes* distal end of tarsometatarse; posterior side.

Fig. 7b.—*Dromaius gracilipes* distal end of tarsometatarse; anterior side.

Fig. 8a.—*Metapteryx bifrons* distal half of tarsometatarse; anterior side.

Fig. 8b.—*Metapteryx bifrons* distal half of tarsometatarse; posterior side.

Fig. 9a.—*Apteryx mantelli* tarsometatarse; anterior side.

Fig. 9b.—*Apteryx mantelli* tarsometatarse; posterior side.

OBSERVATIONS ON PLANTS, COLLECTED DURING MR. JOSEPH BRADSHAW'S EXPEDITION TO THE PRINCE REGENT'S RIVER.

By Baron von Mueller, K.C.M.G., M.D., Ph.D., F.R.S.

During the months of March, April, and part of May of this year, Mr. Joseph Bradshaw, an enterprising Melbourne citizen, conducted a private exploring expedition from Cambridge Gulf to Prince Regent's River, whereby, for the first time, some of the waters of that gulf became geographically connected with rivers flowing into Brunswick Bay. Thus now only the upper portion of Prince Regent's River became explored, although already 71 years ago Admiral Ph. P. King had discovered the estuary and lower portion of that stream. With praiseworthy circumspectness, in this expedition, unlike in many others, the leader of the party made arrangements for securing botanic material during this enterprise, that particular task being specially entrusted to Mr. William Tucker Allen. The results, which also in this respect have rendered Mr. Bradshaw's expedition a very successful one, have been recorded in the following pages, with the prospect that during the soon commencing pastoral occupation of the Prince Regent's River country also botanic along with geographic exploits will be continued.

Nymphaea coerulea, Savigny.

Woodhouse River.

From this locality is brought what appears to be a small-flowered variety of the above-named species, which is generally regarded as identical with *N. stellata*, but was published one year earlier. The only flower obtained has the sepals and petals barely one inch

long; it shows the stamens of *N. stellata*, not of *N. gigantea*, although Prof. Caspary recorded already, 1866 (Miq. Annal. Mus. Lugd. Batav. II. 247), also a small flowered variety of that species from Queensland, which might readily be taken for *N. tetragona*, but has different stamens, and differs also in some other respects. The whole subject will soon be fully discussed in an essay on Sir Will. Macgregor's latest Papuan plants, among which occurs also a small-flowered *Nymphaea*.

Hibbertia lepidota, R. Brown.

Prince Regent's River.

Roeperia cleomoides, F.v.M.

Durack River, and between the Forrest and Drysdale Rivers. Found also at Cambridge Gulf by Johnston and on the Leichhardt River by Armit.

Sprengel with remarkable definiteness makes his *Roeperia* supersede *Ricinocarpus*. Should, therefore, in publications from before 1817, his naming have become established, then the homonymous capparideous genus might receive the name of Prof. Paul Falkenberg, the present successor of Roeper in Rostock. Eichler in his highly important Pflanzen-Diagramme, II. 208 and 211, fully also sustains the generic validity of our *Roeperia*.

Drosera Indica, Linné.

Durack River and Paradise Creek.

Stem to 1½ feet high. The petals of some of the specimens rose-coloured and nearly half an inch long.

Drosera petiolaris, R. Brown.

Paradise Creek.

Byblis liniflora, Salisbury.

Durack River.

Habitually resembling small forms of *Drosera Indica*. Traced southward to near the Gascoyne River by Mr. H. S. King. Petals not rarely denticulated.

COCHLOSPERMUM HETERONEMUM, F.v.M.

Prince Regent's River.

POLYGALA CHINENSIS, Linné.

Prince Regent's River.

POLYGALA LEPTALEA, De Candolle.

Carson's River.

OWENIA VERNICOSA, F.v.M.

Prince Regent's River.

Some of the leaflets may become reduced to eight.

HIBISCUS PANDURIFORMIS, Burmann.

Woodhouse River.

HIBISCUS ZONATUS, F.v.M.

Prince Regent's River.

A variety with velvety vestiture, proportionately broader leaves, twenty-cleft involucel not fissured to the base. This species differs from all other Australian congeners already in the larger number of involucellar segments; from the allied *H. Goldsworthii* besides in the thinner and closer indument, less acutely denticulated leaves and nearly glabrous petals. This plant was traced southward by the Hon. Sir John Forrest to the Sherlock River, and by Mr. H. S. King to near the Gascoyne River.

GOSSYPIUM THESPESIOIDES, F.v.M.

Prince Regent's River.

A variety with cordate leaves, glabrous on the surface; the involucel is three times shorter than the calyx, and has several very short and narrow lobes; the petals are shiningly tomentellous outside except towards the summit; the glandular dots, characteristic for *Gossypium*, are much concealed.

GOSSYPIUM COSTULATUM, Todaro.

Welcome Creek; sources of the Prince Regent's and Row's Rivers. Leaning up to 5 feet on rocks.

Branches slender and lax. Involucellar bracts lanceolar, hardly half as long as the calyx. Petals rose-coloured, fully 2 inches long, outside partly beset with minute hairlets. Upper portion of the style tomentellous.

ABUTILON LEUCOPETALUM, F.v.M.

Prince Regent's River.

BRACHYCHITON PARADOXUS, Schott.

Prince Regent's River.

BRACHYCHITON DIVERSIFOLIUS, R. Brown.

Carson's River.

The gum brought by Mr. Bradshaw is almost colourless, and occurs in lumps of considerable size.

WALTHERIA INDICA, Linné.

Durack River.

It ranges on the west coast southward to Nickol Bay, according to collections from the Hon. Sir John Forrest.

TRIUMFETTA BRADSHAWII.

Branchlets rather densely beset with long fasciculate spreading hairlets; leaves comparatively large, ovate-lanceolar or somewhat cordate, acuminate, occasionally short-trilobed, crenulate-serrate, above closely provided with a subtle stellular indument, beneath thinly grey-velvety, and there the reticular venules prominent, on both sides bearing some scattered fascicular long hairlets; stipules long, filiform-linear, as well as the petioles, peduncles and sepals, beset with fascicular elongated hairlets; flowers quite large, often solitary; sepals broad linear, with a generally conspicuous appendage behind their summit; stamens extremely numerous; anthers

considerably longer than broad; style elongated, capillary-thin, near the base pubescent; stigmas minute; torus densely long-villous; fruit unusually large, almost globular, very hard, doubly five-celled, ten-seeded, densely beset with rather short flexuous fascicular-hispid bristlets; seeds considerably compressed.

In the vicinity of Prince Regent's River; Bradshaw and Allen. Near Cambridge Gulf; Keiller.

Leaves to 5 inches long and to 2 inches broad, often lobeless. Length of petiole at an average one inch. Pedicels conspicuous. Sepals about $\frac{1}{2}$ inch long or still longer, especially when the appendage becomes enlarged and divided. Petals already dropped from only flower obtained. Stamens fully half an inch long, if not longer. Style measuring about $\frac{2}{3}$ inch in length. Size of fruit quite one inch; the vestiture comparatively short, but intricate; pericarp very thick and tough; secondary dissepiments nearly as thick as the others. Seeds $\frac{1}{6}$-$\frac{1}{4}$ inch long, outside brownish.

In some respects allied to *T. Fabreana*, from the Marianes, but with a different indument, longer more pointed leaves, elongated stipules, much larger flowers, almost innumerable stamens, also fruits of greater size and of interwoven vestiture. From *T. Johnstoni*, to which it comes nearest in fruit-indument, easily separable by the conspicuously longer but less close vestiture of the branches, pedicels and sepals, by the larger and particularly broader leaves, by the much greater size of the flowers and fruits, by the much longer but less straight and more hispid fruit-setules, and by the number of the dissepiments and seeds.

T. Winneckeana stands still further apart; its vestiture is quite short, its leaves are comparatively small, its fruit-setules rigidly straight and only short-hispidulous or getting glabrous. That plant was found also on the Ashburton River by Mr. H. St. Carey. *T. appendiculata* is devoid of the long hairlets of our new plant, and has the fruits considerably smaller, rigidly setulous and doubly three-celled.

TRIUMFETTA PLUMIGERA, F.v.M.

Carson Valley.

Corchorus Allenii.

Branchlets thinly beset with stellular hairlets; leaves on very short petioles, narrow- or elongate-lanceolate, without any conspicuous denticulation, on both sides provided with a subtle stellular greyish indument; stipules very short, fugacious; pedicels comparatively short; flowers very small, solitary; calyx tubular and undivided towards the base; fruit ovate-ellipsoid, five-celled, densely beset with short soft flexuous stellular-hispidulous bristlets; seeds about four in each cell.

Near Prince Regent's River; Bradshaw and Allen.

Leaves 2-3 inches long, $\frac{1}{3}$–$\frac{1}{2}$ inch broad. Good flowers not obtained. Petals seen in a shrivelled state, and seemingly only $\frac{1}{8}$ inch long. Fruit about $\frac{3}{8}$ inch long, its setules somewhat flattened, forming a dense grey vestiture, the uppermost of them often slightly dilated and then constituting a rather distinct termination to the fruit. Seeds brown outside, glabrous.

Although the fruit-setules are somewhat similar to those of *Triumfetta Bradshawii*, yet the plant falls systematically into *Corchorus*, no absolute differences existing between the two genera. It approaches in some respects *C. echinatus*, in others *C. hirsutus*, but as regards the characteristics of the fruit-indument, this species stands quite apart among its known congeners, except *C. Elderi*; but that has the leaves much smaller and distinctly denticulated, the fruits also of much lesser size, with shorter setules, the seeds fewer and of course smaller.

Grewia polygama, Roxburgh.

Carson River.

Petalostigma quadriloculare, F.v.M.

Prince Regent's River. Known now also from Wickliffe's Creek in Central Australia (Flint).

Sebastiania chamaelea, J. Mueller.

Prince Regent's River.

EUPHORBIA SCHIZOLEPIS, F.v.M.

Prince Regent's River.

The glabrous variety. Some of the involucral appendages only bilobed.

BRIDELIA TOMENTOSA, Blume.

Prince Regent's River.

FICUS PLATYPODA, Cunningham.

Prince Regent's River.

ATALAYA HEMIGLAUCA, F.v.M.

Carson Valley.

DISTICHOSTEMON PHYLLOPTERUS, F.v.M.

Paradise Creek.

The only plant in the vast order of Sapindaceæ with an indefinite number of stamens, just as among the many hundreds of cruciferous plants *Megacarpaea polyandra* is the only one with more than 6 stamens.

CANARIUM AUSTRALASICUM, F.v.M.

Prince Regent's River. Found also on the Catherine River by A. Giles and at Port Douglas by Barnard.

POLYCARPAEA LONGIFLORA, F.v.M.

Prince Regent's River.

Particularly well worthy of culture as a kind of everlasting on account of its copious dark red flowers.

GOMPHRENA LEPTOCLADA, Bentham.

Prince Regent's River.

GOMPHRENA FLACCIDA, R. Brown.

Prince Regent's and Durack Rivers. Found also at King's Sound (Poulton), Fitzroy River (G. Paterson), Norman River (Gulliver), Goode Island (Poulton), Ennesleigh River (Armit), Creen's Creek (Stockfeldt).

Not rarely of firm strictness and perhaps perennial. The leaves not seldom widened to a narrow-lanceolar form, and often bearing conspicuous vestiture. Sepals from white to rosy-red; in the latter case the plant becomes highly ornamental.

GOMPHRENA CANESCENS, R. Brown.

Prince Regent's River. Occurs also in Dampier's Archipelagus (Walcott), Fitzroy River (Paterson), Lagrange Bay (Panton), Yule River (Hon. Sir John Forrest), Georgina River (St. Dittrich).

Mr. Bradshaw singles this out for record as a pasture-herb, consumed with predilection by his horses. *G. globosa* has been gathered in N.E. Queensland, but perhaps only as a garden-fugitive.

PTILOTUS CORYMBOSUS, R. Brown.

Carson Valley.

PTILOTUS SPICATUS, F.v.M.

Woodhouse River.

Summit of spike yellowish. A particularly neat plant for pot culture.

PTILOTUS GRACILIS, Poiret.

Woodhouse River.

PTILOTUS ALOPECUROIDES, F.v.M.

Durack River.

TRIANTHEMA PILOSA, F.v.M.

Prince Regent's River.

PORTULACA DIGYNA, F.v.M.

Prince Regent's River.

PORTULACA AUSTRALIS, Endlicher.

Prince Regent's River.

Clearly Bauer's plant.

CLAYTONIA UNIFLORA, F.v.M.

Sandy country at the Pentacost River.

SALSOLA KALI, Linné.

Prince Regent's River.

Incidentally it may here be stated that the restitution of *Osteocarpum* (in the Iconography of Australian Salsolaceous Plants) requires *Babbagia* to merge into that genus.

GASTROLOBIUM GRANDIFLORUM, F.v.M.

In the Callitris-tracts of the Forrest and Drysdale Rivers. Known now also from the Upper Belyando (Sutherland), Aramac Creek (O'Shanesy), Alice Springs (Flint), Suttor River, Paroo (Sir S. Wilson).

Specimens sent by Mr. McRae from the Nickol Bay country have the upper petal darker and the fruit appressedly beset with hairlets.

BURTONIA SUBULATA, Bentham.

Prince Regent's River.

BOSSIAEA PHYLLOCLADA, F.v.M.

Forrest, Carson's, Roe's and Drysdale Rivers.

CROTALARIA VERRUCOSA, Linné.

Prince Regent's River.

CROTALARIA LINIFOLIA, Linné, *fil.*

Durack River.

CROTALARIA CALYCINA, Schranck.

Prince Regent's River.

CROTALARIA RETUSA, Linné.

Carson Valley. Obtained latterly also at Cambridge Gulf (Johnston), Fitzroy River (Forrest), Ord River (O'Donnell), Strangeway River (Waterhouse).

CROTALARIA CRASSIPES, Hooker.

Prince Regent's River.

The leaflet may attain a breadth of 2 inches.

CROTALARIA MEDICAGINEA, Lamarck.

Prince Regent's River. Gathered also near the Macdonell Ranges with *C. incana.*

CROTALARIA LABURNIFOLIA, Linné.

Carson River.

CROTALARIA ALATA, Hamilton.

Paradise Creek.

PSORALEA BODACANA, Blanco.

Carson Valley.

PSORALEA TESTARIAE, F.v.M.

Prince Regent's River.

INDIGOFERA LINIFOLIA, Retzius.

Durack River.

INDIGOFERA TRIFOLIATA, Linné.

Prince Regent's River.

INDIGOFERA VISCOSA, Lamarck.

Prince Regent's River. Observed also recently at King's Sound (Poulton), and on the Finke River (Kempe).

INDIGOFERA HIRSUTA, Linné.

Prince Regent's River.

SESBANIA GRANDIFLORA, Persoon.

Prince Regent's River.

Mr. L. Gould saw trees to 40ft. high at Nickol Bay.

DESMODIUM PARVIFOLIUM, De Candolle.

Prince Regent's River.

A variety with partly unifoliolate leaves of obcordate-orbicular form.

DESMODIUM BIARTICULATUM, F.v.M.

Carson River. Also on the Adelaide River (Prof. Tate).

PYCNOSPORA HEDYSAROIDES, R. Brown.

Prince Regent's River.

URARIA CYLINDRACEA, Bentham.

Prince Regent's River. Also at Port Darwin (Foelsche).

CANAVALIA OBTUSIFOLIA, De Candolle.

Littoral region of the Prince Regent's River country.

ERYTHRINA VESPERTILIO, Bentham.

Prince Regent's River.

FLEMINGIA LINEATA, Roxburgh.

Durack River.

FLEMINGIA PAUCIFLORA, Bentham.

Carson River. The same or a closely allied species has been found by Bowman near the Suttor River.

CASSIA MIMOSOIDES, Linné.

Woodhouse River.

CASSIA CONCINNA, Bentham.

Prince Regent's River.

ACACIA TRANSLUCENS, Cunningham.

Roe's River.

ACACIA LYCOPODIFOLIA, Cunningham.

Woodhouse and Pentacost Rivers.

The first leaves of the seedlings consist of two pubescent pinnæ, with the leaflets in few or several pairs and of obliquely lanceolar-ovate somewhat dimidiate form.

Acacia hemignosta, F.v.M.

Prince Regent's River.

Acacia flavescens, Cunningham.

Prince Regent's River.

The form formerly distinguished as *A. sericata*.

Acacia Kelleri.

Pubescent, unarmed; phyllodes small, much crowded, linear or slightly lanceolar, mucronulate, hardly or somewhat spreading, many-streaked by subtle equal venules; stipules conspicuous, semilanceolate-linear, scarious, closely overtopping the young foliage; spikes short-stalked, cylindric, close-flowered; bracts lanceolar, acuminate, sessile or short-stipitate, as well as the sepals and petals outside puberulous; sepals almost disconnected, broadened towards their upper end, petals exceeding by half the length of the calyx, flaccid, blunt, connate towards the base, fruit rather long, but narrow, straight, irregularly cylindric; seeds placed longitudinally, not much narrower than the valves, ellipsoid, shining-black, clasped only at their base by the pale brownish somewhat bilobed strophiole.

Durack River.

Phyllodes $\frac{1}{2}$-$\frac{3}{4}$ inch long. Spike attaining about $1\frac{1}{2}$ inches in length. Peduncle and rhachis velvety pubescent. Fruit 3-4 inches long, but only $\frac{1}{8}$-$\frac{1}{6}$ inch broad. Seeds about $\frac{1}{6}$ inch long.

In the system this species must find its place near *A. linarioides*, *A. stipuligera* and *A. conspersa*; from the first-mentioned it differs already in copious vestiture, in the venulation of the phyllodes and conspicuity of stipules; from *A. stipuligera* chiefly in very much smaller and very numerous phyllodes; from *A.*

conspersa again in the small and also acute phyllodes without any prominent median venule; from all in the less elongated strophiole.

This species is dedicated to the memory of Heinrich Keller of Darmstadt, one of the leading promoters of rural culture during the latter half of this century through many parts of the world.

ACACIA SUBEROSA, Cunningham.

Carson River.

ACACIA PALLIDA, F.v.M.

Carson River.

NEPTUNIA MONOSPERMA, F.v.M.

Woodhouse River.

ALBIZZIA CANESCENS, Bentham.

Prince Regent's River.

VERTICORDIA CUNNINGHAMI, Schauer.

Prince Regent's River.

CALYCOTHRIX MICROPHYLLA, Cunningham.

Prince Regent's River.

EUCALYPTUS PTYCHOCARPA, F.v.M.

Welcome Creek, Roe's and Drysdale Rivers, chiefly on the banks of tributaries.

EUCALYPTUS TERMINALIS, F.v.M.

Prince Regent's River.

EUCALYPTUS TETRODONTA, F.v.M.

Prince Regent's River.

METROSIDEROS PARADOXA, F.v.M.

Prince Regent's River.

On watercourses in the coast-region.

CARYA AUSTRALIS, F.v.M

Prince Regent's River

OSBECKIA AUSTRALIANA, Naudin

Prince Regent's River.
The narrow-leaved variety

TERMINALIA MICROCARPA, Decaisne

Prince Regent's River.
The diagnostic limits of this species are not yet well fixed

PIMELEA PUNICEA, R. Brown.

Durack River.

PIMELEA SANGUINEA, F.v.M.

Paradise Creek.

STACKHOUSIA VIMINEA, Smith.

Carson River.

LUDWIGIA PARVIFLORA, Roxburgh

Pentacost River.

ROTALA VERTICILLARIS, Linn.

VITIS TRIFOLIA, Linné.

Durack River.

VITIS ACETOSA, F.v.M.

Away from the saline coastal tracts widely distributed through the whole region, this being indicative of the ease with which the culture of this grape-vine of tropical Australia could be effected in adequate climes.

PERSOONIA FALCATA, R. Brown

Prince Regent's River.

STENOCARPUS CUNNINGHAMI, R. Brown.

Prince Regent's River.

GREVILLEA DRYANDRI, R. Brown.

Prince Regent's River.

Petals always red.

GREVILLEA HELIOSPERMA, R. Brown.

Prince Regent's River.

GREVILLEA AGRIFOLIA, Cunningham.

Paradise Creek.

Fruit of nearly one inch measurement. Seeds broadly surrounded by a membranous expansion.

HAKEA ARBORESCENS, R. Brown.

Prince Rege[illegible]ver.

[illegible]ta [illegible] [illegible]né, fil

Pr[illegible] Re[illegible]

[illegible] R. Brown.

LORANTHUS ACACIOIDES, Cunningham.

Durack River.

LUFFA GRAVEOLENS, Roxburgh

Pentacost River.

KNOXIA CORYMBOSA, Willdenow.

Prince Regent's River.

HELICHRYSUM LUCIDUM, Henckel.

Prince Regent's River.

PLUCHEA TETRODONTA, F.v.M.

Durack River.

LESCHENAULTIA AGROSTOPHYLLA, F.v.M

Paradise Creek.

JASMINUM SIMPLICIFOLIUM, G. Forster.

Prince Regent's River.

MITRASACME LONGIFLORA, F.v.M.

Carson River.

Flower-stalklets to 2 inches long.

STRYCHNOS LUCIDA, R. Brown.

Roe and Drysdale Rivers.

The pulp of the fruit is liked by some birds and seems harmless to them.

SIDEROXYLON ARNHÉMICUM, J. Hooker

Between Roe and Drysdale Rivers.

A variety with glabrescent leaves.

SARCOSTEMMA AUSTRALE, R. Brown.

Prince Regent's River.

CYNANCHUM PEDUNCULATUM, R. Brown.

Pentacost River.

Fruitlets 2-3 inches long, about $\frac{3}{8}$ inch broad, much gradually attenuated upwards, glabrous. Seeds about $\frac{1}{4}$ inch long.

CYNANCHUM FLORIBUNDUM, R. Brown.

Prince Regent's River.

RAMPHICARPA MACROSIPHONIA.

Annual, imperfectly glandular-puberulous; basal leaves crowded, somewhat ovate, those of the stem opposite, gradually narrower, grossly and distantly indented or short-lobed, the floral leaves almost linear; pedicels several times longer than the calyx, angular, finally refracted; calyx deeply cleft into five rather narrow segments; tube of the corolla extremely long, filiform to near the summit, the lobes twice or thrice shorter; two of the stamens rudimentary; style capillary; stigma conspicuously dilated, its lobes membranous, somewhat unequal, minutely fimbriolated; capsule ovate, acute, much shorter than the calyx.

Prince Regent's River.

A showy flaccid herb, up to $1\frac{1}{2}$ feet high. Lower leaves to $1\frac{1}{2}$ inches long, uppermost leaves reduced to bracts. Pedicels to $1\frac{1}{2}$ inches long. Calyx measuring about $\frac{1}{3}$ inch in length. Corolla said to be buff-coloured, perhaps at first whitish, of tender texture, outside glabrous; its tube fully three inches long or even longer. Fertile stamens short, inserted in the upper widened part of the corolla-tube. Capsule bivalved, only about $\frac{1}{6}$ inch long, though split yet not seen in perfect development.

The plant is here left in *Ramphicarpa*, from which however the presence of only two fertile stamens removes it, so that it would best be considered a distinct genus, and should receive then the name *Bradshawia* in honour of the discoverer. From well-matured fruit perhaps other generic differences could be pointed out hereafter.

BUECHNERA BROWNIANA, Schinz in Verhandl. des bot. Vereins von Brandenburg, xxxi. 194.

Woodhouse River.

CENTRANTHERA HISPIDA, R. Brown.

Durack River.

HEMODIA LYTHRIFOLIA, F.v.M.

Carson River.

DOLICHANDRONE HETEROPHYLLA, F.v.M.

Carson River.

STELIOTROPIUM TENUIFOLIUM, R. Brown.

Woodhouse and Pentacost Rivers.

POLLICHIA ZEYLANICA, F.v.M.

Prince Regent's River.

ANISOMELES SALVIFOLIA, R. Brown.

Carson River.

DICLIPTERA GLABRA, Decaisne.

Carson River.

HYPOESTES FLORIBUNDA, R. Brown.

Prince Regent's River.

Messrs. M. and N. Holtze, as also Mr. W. Carr-Boyd, found inland some distance from Port Darwin a *Hypoestes*, which in the eighth edition of the "Select Plants for Industrial Culture and Naturalisation" received the name *H. moschata*, on account of the powerful musk-odour, which pervades the whole plant. Whether it can systematically or only industrially be distinguished from *H floribunda* may best be ascertained by observations and comparisons in free nature.

CYCAS MEDIA, R. Brown.

Prince Regent's River.

DIOSCOREA SATIVA, Linné.

Woodhouse River, on alluvial banks. The plant is now also known from the vicinity of Endeavour River.

THYSANOTUS CHRYSANTHERUS, F.v.M.

Durack River.

Seed-testule shining-black, punctular-rough.

CARTONEMA SPICATUM, R. Brown.

Woodhouse and Carson Rivers.

COMMELINA ENSIFOLIA, R. Brown.

Prince Regent's River.

The variety with linear leaves. Root consisting of a fascicle of strong and rather long fibrilles.

LIVISTONA sp.

Sandstone Tableland.

The collection contains only leaves, the stalks of which are smooth. This fan-palm was nowhere high, 10 feet being the maximum height, so far as observed.

XEROTES BROWNII, F.v.M.

Welcome Creek.

The form distinguished by R. Brown as *X. media* among the six designated by him with separate specific names. To select any one of these for the total forms of the species would not be an exact record.

FLAGELLARIA INDICA, Linné.

Prince Regent's River.
Endures the clime of Port Phillip without protection.

ERIOCAULON SETACEUM, Linné.

Woodhouse River.

FUIRENA UMBELLATA, Rottboell.

Prince Regent's River.

PASPALUM SCROBICULATUM, Linné.

Prince Regent's River. Mr. Baeuerlen has traced this as a native plant as far south as Shoalhaven.

PANICUM INDICUM, Linné.

Prince Regent's River.

PANICUM BREVIFOLIUM, Linné.

Prince Regent's River.
The extremely delicate small form, distinguished by R. Brown as *P. minutum.*

PANICUM MAJUSCULUM, F.v.M.

Durack River.
Outer floral bract five-streaked. Grain whitish, shining, quite smooth.

SETARIA GLAUCA, Beauvois.

Prince Regent's River.

MANISURIS GRANULARIS, Swartz.

Carson River.

ERIACHNE OBTUSA, R. Brown.

Woodhouse River.

ERIACHNE SQUARROSA, R. Brown.

Prince Regent's River.

ARUNDINELLA NEPALENSIS, Trinius.

Prince Regent's River.

ANDROPOGON PROCERUS, R. Brown.

Carson River.

Called during this journey the Giant-Lemongrass. Found to grow to 9 feet in height.

ANDROPOGON SERICEUS, R. Brown.

The variety *polystacha.*

Pentacost River.

Called during this expedition the Tazel-Grass.

ANDROPOGON TRITICEUS, R. Brown.

Prince Regent's River.

ANDROPOGON MONTANUS, Roxburgh.

Prince Regent's River.

ERIANTHUS IRRITANS, Kunth.

Prince Regent's River.

THEMEDA ARGUENS, Hackel.

Roe and Carson Rivers.

The leaf stalks of these specimens are glabrous. Prof. Hackel has placed the *Anthistiria membranacea* generically apart as an *Iseilema*, but I prefer to put it under Lindley's specific name into *Themeda*. The ordinary kangaroo-grass is common also there.

ROTTBOELLIA FORMOSA, R. Brown.

Prince Regent's River.

ECTROSIA LEPORINA, R. Brown.

Prince Regent's River.

TRIODIA PROCERA, R. Brown.

Desert on the tablelands at Prince Regent's River. Mentioned by the travellers as the resinous *Spinifex* and as a fibre-plant.

GLEICHENIA PLATYZOMA, F.v.M.

Upper Drysdale and Forrest Rivers.

CHEILANTHES TENUIFOLIA, Swartz.

Prince Regent's River.

This is the widest distributed fern in Australia; to judge from its frequency it could be naturalised with ease in mild regions elsewhere.

CHEILANTHES VELLEA, F.v.M.

Carson River.

Mr. Bradshaw saw also a *Lygodium* entwining to a considerable height some trees.

NOTES ON AUSTRALIAN COLEOPTERA, WITH DESCRIPTIONS OF NEW SPECIES.

By the Rev. T. Blackburn, B.A., Corr. Mem.

Part X.

CARABIDÆ.

Lecanomerus major, sp.nov.

Nitidus; piceo-niger vix cæruleo-micans, labro mandibulis (apice excepto) palpis antennis pedibus (his plus minusve infuscatis) et prothoracis lateribus testaceis; prothorace parum transverso, vix perspicue punctulato, lateribus postice vix sinuatis basin versus fortiter explanatis, angulis posticis bene determinatis obtusis fere erectis; elytris leviter striatis, interstitiis planis.

♂ segmento ventrali apicali postice triangulariter emarginato, utrinque puncto setifero instructo, ad latera profunde sinuato.

♀ latet. [Long. 4, lat. $1\frac{1}{8}$ lines.

The striation of the elytra is a little stronger than in *L. flavocinctus*, Blackb., and the prothorax is of quite different outline, having the sides subsinuate behind the middle and the posterior angles not at all rounded off.

N.S.W.; near Burrawang; taken by Mr. T. G. Sloane.

Lecanomerus striatus, sp.nov.

Nitidus; ut *L. major* coloratus; prothorace leviter transverso, basin versus leviter perspicue punctulato, lateribus postice leviter sinuatis basin versus minus explanatis, angulis posticis rectis; elytris fortius striatis, interstitiis leviter convexis.

♂ segmento ventrali apicali postice haud emarginato, utrinque puncto setifero instructo, ad latera profunde sinuato.

♀ segmento ventrali apicali postice magis late rotundato, utrinque punctis setiferis 2 instructo, ad latera profunde sinuato; elytris minus nitidis paullo minus fortiter striatis.

[Long. $3\frac{3}{5}$, lat. $1\frac{2}{5}$ lines.

The elytra are considerably more strongly striate than in *L. major* and the hind angles of the prothorax less explanate and more rectangular. The hind angles of the prothorax not rounded off will separate this species from all the others of the genus yet described. The male sexual characters are much like those of *L. flavocinctus*.

N.S.W.; near Burrawang; taken by Mr. T. G. Sloane.

Cyclothorax eyrensis, sp. nov.

Modice convexus, nitidus, antennis palpis pedibusque testaceis, prothorace leviter transverso, trans basin punctulato haud depresso, utrinque ante basin fovea sat perspicua instructo, lateribus valde rotundatis ante basin fortiter sinuatis, angulis posticis acute dentiformibus, elytris manifeste 6 striatis, striis sat fortiter nec crebre punctulatis postice obsoletis.

[Long. 2, lat. 1 line (vix).

Differing from all the other Austraian species of *Cyclothorax* known to me by the sharply dentiform hind angles of its prothorax, this species is nearest I think to *C. peryphoides*, Blackb.; it is however more convex than that insect with much more distinctly striate elytra, the striæ being more strongly punctulate. All the striæ are abbreviated behind, and are successively shorter from the sutural one. Besides the 6 striæ on the disc of the elytra there is as usual in the genus a stria near the external margin.

S. Australia; basin of Lake Eyre.

Cyclothorax punctipennis, Macl.

In P.L.S.N.S.W., 1888, p. 1388, I made some remarks on this species founded on a specimen named for me by Sir W. Macleay.

I have lately received through the kindness of Mr. Sloane an example from Queensland (stated by Mr. Masters to appertain to that species) which is clearly distinct from that named by Sir W. Macleay,—and also various specimens taken in N. S. Wales and elsewhere, a study of which points to the probability that the name received from Sir W. Macleay was wrong, as all the examples before me from localities North of about the latitude of Sydney are like the Queensland specimen referred to above. It differs from the form common in Southern Australia chiefly by its much more strongly sculptured elytra, the punctures in the striæ especially being stronger and much less closely placed. I am afraid therefore that the species I have hitherto called *C. punctipennis*, Macl., is not that species (it is probably *C. lophoides*, Chaud.). This is particularly unfortunate because in the descriptions of two new species I have pointed out their differences from the common Southern Australian form under Sir W. Macleay's name for it. If this correction be right it will be necessary to note that where the name *C. punctipennis*, Macl., occurs in the descriptions of *C. fortis*, Blackb., and *C. obsoletus*, Blackb., it is not the true *punctipennis* that is referred to, but the species of *Cyclothorax* (plentiful throughout Southern Australia) which is distinguished from all its congeners (at any rate from all known to me) except *C. obsoletus*, by the very fine close puncturation of the scarcely impressed striæ on its elytra.

LAMELLICORNES.

DIPHUCEPHALA ELEGANS, sp.nov.

Robusta; splendide viridis, tibiis cupreo-micantibus; nitidissima; subtus pilis albis decumbentibus vestita; capite crebre fortius, prothorace fortiter vix crebre, punctulatis; hoc et longitudinaliter et transversim late sulcato, marginibus lateralibus dente magno acuto ad medium instructis et pone apicem fortiter crenulatis, angulis anticis fortiter productis acutis; scutello lævi; elytris crasse punctatis; pygidio creberrime vix aspere punctulato albido-pubescenti.

[Long. $4\frac{4}{5}$, lat. $2\frac{2}{3}$ lines.

This remarkably fine species resembles *D. aurulenta*, Kirby, from which it differs apart from colour in its considerably larger size, in the extremely strong apical angles of its prothorax, the larger lateral tooth of the same, the sides strongly crenulate in their front half, the longitudinal channel not divided and the transverse sulcus entire, also in the differently punctured pygidium.

Victoria; a single specimen flying on the summit of the Buffalo Mountain.

CHEIRAGRA MACLEAYI, sp.nov.

♂. Nigra, vix cupreo-micans, elytrorum singulorum disco toto testaceo; capite pygidioque crebre fortius, prothorace fortiter sat sparsim, punctulatis; hoc vix transverso, antice in medio leviter canaliculato, lateribus sat fortiter rotundatis ante basin fortiter sinuatis, angulis posticis acutis; scutello fortiter sparsim punctulato, elytris vix striatis, sparsim crasse nec profunde punctulatis; unguiculis anterioribus 4 brevibus dilatatis basi processubus 2 (fere ut quarundam Mæchidii specierum) instructis, posticis elongatis gracilibus; antennarum clava quam stipes parum breviori; tarsorum posticorum articulo 2° quam 1^{us} multo longiori; corpore subtus albo-piloso.

♀. Paullo latior; rufo-testacea, vix cupreo-micans, elytris pallidioribus, unguiculis simplicibus; antennarum clava (hac infuscata) quam stipes sat breviori.

[Long. 2, lat. 1 line (vix).

Victoria; on flowers in the Alpine district.

LIPARETRUS SPRETUS, sp.nov.

Ovatus; sat nitidus; niger, antennis (clava excepta) palpis tarsisque ferrugineis, elytris læte cæruleo-micantibus; clypeo antice sat fortiter 3-dentato; capite prothoraceque (his pilis nigricantibus erectis elongatis sat crebre vestitis) dupliciter sat crasse punctulatis (hoc quam illud minus crebre), elytris (his geminato-striatis et postice setis validis subspiniformibus

marginatis) fortiter sat crebre, pygidio propygidioque (hoc pilis nigris, illo pilis cinereis, erectis sat brevibus vestitis) sat crasse sat crebre, punctulatis; tibiis anticis externe sat fortiter 3-dentatis; tarsorum posticorum articulo 2° quam 1^{us} paullo breviori; antennis 9-articulatis.

[Long. 3½, lat. 2 lines.

This species belongs to Sir W. Macleay's "sub-section II" of the genus distinguished by the clypeus (in the male at least) having its apex "more or less tridentate." I believe I know all the species except *asper*, Macl., and *iridipennis*, Germ., of the sub-section at all resembling this one in size and colouring, and find that they all differ from it *inter alia* in not having the elytra margined behind by a row of stiff stout bristles. *L. iridipennis* is described as having its pygidium glabrous, its prothorax "finely" punctured, &c., while *inter alia* the prothorax of *L. asper* is described as having "a frill of long erect black hairs on the base, apex and sides" (the whole surface in the present insect being evenly clothed with long erect hairs).

This insect is near *L. sylvicola*, Fabr., from which (apart from the character mentioned above) it differs in the considerably stronger dentation of the front of its clypeus, in the somewhat coarser puncturation of its prothorax, and in the same being distinctly two-fold consisting of large and small punctures confusedly mingled together.

N.S. Wales; taken by Mr. Froggatt, near Sydney.

LIPARETRUS ALPICOLA, sp.nov.

Elongato-ovatus; sat nitidus; depressus; piceo-niger, antennarum basi tarsisque plus minus rufescentibus, elytris testaceo-rufis; capite prothorace pygidio propygidioque sat fortiter vix crebre squamose vel subgranulatim (his sat dense pilis erectis fuscis vestitis), elytris (his obsolete bicostatis et pilis brevibus erectis vestitis) fortiter confuse,—maris quam feminæ magis crebre,—punctulatis; tibiis anticis ad apicem 2-dentatis et ante basin (♂ vix, ♀ magis, distincte) 1-dentatis;

tarsorum posticorum articulo 2° quam 1[us] duplo longiori; antennis 8-articulatis; prothoracis lateribus subrectis, angulis posticis præter modum distinctis et retrorsum productis.

♂ antennarum clava quam stipes haud breviori, clypeo antrorsum fortiter quadratim producto, tarsis crassis.

♀ antennarum clava quam stipes paullo breviori, clypeo antrorsum subquadratim minus fortiter producto, tarsis minus crassis. [Long. $3\frac{2}{5}$, lat. $1\frac{3}{5}$ lines.

This is a very abnormal *Liparetrus*, but allied I think to *L. ferrugineus*, Blanch., which it resembles in having antennæ consisting of only 8 joints, and in its sexual characters (the male having the clypeus more produced and reflexed and the antennal club much longer and the tarsi much stouter, than the female). It presents however the structural difference from *L. ferrugineus* of having *antennæ* almost of the *Scitala* type, the joints of the club being of almost equal length and in the male not at all shorter than all the preceding joints together. The teeth of the anterior tibiæ too are very different from those of *L. ferrugineus* being distinctly of the *L. depressus*, Blanch., type. This species is not capable of confusion I think with any previously described species. The sides of the prothorax almost straight and narrowed from base to apex and the strongly developed hind angles of that segment are very distinctive.

Victoria; Alpine district.

LIPARETRUS BRUNNEIPENNIS, sp.nov.

Ovatus; sat nitidus; minus depressus; supra (elytris exceptis) longe griseo-pilosus; niger, antennis (clava excepta) et nonnullis exemplis palpis tarsis abdomineque plus minusve rufescentibus, elytris testaceo-brunneis margines versus anguste infuscatis; clypeo prothorace pygidio et propygidii parte postica fortiter rugulose, capite postice et propygidio antice magis subtiliter magis crebre, elytris (his obscure geminato-striatis) fortiter minus crebre, punctulatis; tibiis anticis externe fortiter (maris quam feminæ minus fortiter)

3-dentatis; tarsorum posticorum articulo 2° quam 1^us^ paullo longiori; antennis 8-articulatis; clypei marginibus lateralibus et anticis truncatis, illis obliquis.

♂ clypeo antice magis fortiter reflexo magis abrupte truncato, tarsis multo crassioribus. [Long. $3\frac{1}{5}$, lat. $1\frac{4}{5}$ lines.

The following characters in combination will distinguish this species I think from all its previously described congeners:—antennæ having only 8 joints, clypeus having three truncate faces, front tibiæ normally tridentate externally, 2nd joint of hind tarsi much less than twice as long as basal joint.

Probably this insect is nearest to *L. ferrugineus*, Blanch., but it has a facies very different from that species and very distinct characters,—*inter alia* the sides of the clypeus are strongly oblique in both sexes, and the femora and tibiæ are uniformly of dark colour.

N.S. Wales; taken by Mr. Froggatt near Mudgee.

HETERONYX BALDIENSIS, sp.nov.

Brevis; validus; fortiter convexus; postice dilatatus; vix nitidus; supra setulis brevissimis vix perspicuis sparsim vestitus; niger, antennis palpis tarsis et pilis erectis in marginibus in pedibus et in corpore subtus positis rufescentibus; capite prothorace scutello pygidioque (hoc pilis erectis vestito) fortiter rugulose sat crebre,—clypeo pygidioque magis crebre,—punctulatis; prothorace quam longiori duabus partibus latiori, antice paullo angustato, basi fere recto, angulis posticis rotundato — rectis, lateribus vix arcuatis; elytris (his basi quam prothoracis basis angustioribus) sparsim leviter nec subtiliter punctulatis, ovatis, nullo modo striatis; corpore subtus (abdomine sat leviter sat crebre subtilius punctulato excepto) fortiter vix crebre punctulato; coxis posticis quam metasternum vix brevioribus; antennis 8-articulatis; labro a clypeo obtecto; tibiis anticis externe fortiter 3-dentatis; unguiculis appendiculatis, unguiculorum posticorum parte basali quam apicalis paullo longiori. [Long. $6\frac{2}{5}$, lat. $3\frac{3}{5}$ lines.

An extremely distinct species which it is possible ought not to be placed in *Heteronyx*, as I have not been able to examine the inner organs of the mouth. Its elytra much narrower at the base than the base of the prothorax and then arcuately dilated to considerably beyond the middle (where they are much wider than the prothorax) give it a facies out of harmony with its congeners, the shortness of the elytra (their length not exceeding the width by much more than a quarter of the latter) is also unusual.

This insect, in my tabulation of *Heteronyx*, would fall in the 1st section (P.L.S.N.S.W., 1888, pp. 1328, &c.) under "FF" on page 1329 beside *H. spretus*, from which, *inter alia multa*, its very much larger size will distinguish it. *H. lilliputanus*, Blackb., (described since the tabulation was published), also falls under "FF" on p. 1329, but is still smaller than *spretus*. The three species probably attributable to "Section I," which I have not succeeded in identifying, are all very different.

Victoria; under a stone on the summit of Baldi in the Victorian Alps, at an elevation of more than 6000 feet.

Heteronyx terrena, sp.nov.

Sat elongatus, postice vix dilatatus; minus nitidus, pallide ferrugineus, antennarum clava testacea, pilis brevibus pallidis sat crebre vestitus, crebre subtilius sat æqualiter punctulatus; labro clypeum haud superanti; antennis 9 articulatis; coxis posticis metasterno plus quam paullo brevioribus; unguiculis appendiculatis; unguiculorum posticorum parte basali quam pars apicalis multo longiori. [Long. 4, lat. 2 lines.

A clay coloured species closely resembling in miniature *H. piceus*, Blanch., but a little narrower and more parallel in outline, with the hind coxæ a little shorter in proportion to the metasternum, and the appendiculation of the hind claws nearer to the apex; the prothorax, moreover, is evidently less transverse, being not more than $\frac{1}{3}$ again as wide as long. I do not observe any other respects in which the characters differ from those of *H. piceus*.

The specimen mentioned in P.L.S.N.S.W., 1889, p. 1228, as possibly a small var. of *H. piceus* is this species.

[redacted]

Victoria; Ballarat (W. W. Froggatt); also N.S. Wales (T. G. Sloane).

HETERONYX INCOGNITUS, sp.nov.

Elongatus; postice dilatatus; subnitidus; ferrugineus, antennarum clava testacea, pilis brevibus fulvis sat sparsim vestitus; capite æqualiter crasse minus crebre, prothorace subtilius sparsius, elytris sparsius sat crebre, pygidio sparsim vix perspicue, squamose punctulatis; labro clypeum haud superanti (hoc antice sat fortiter reflexo); antennis 9-articulatis, unguiculis appendiculatis, unguiculorum posticorum parte basali quam pars apicalis sat longiori; coxis posticis metasterno parum brevioribus. [Long. $5\frac{2}{5}$, lat. $2\frac{3}{5}$ lines.

This species is another ally of *H. piceus*, Blanch. It is a much more elongate species, however, with the ventral series of erect setæ continued strongly all across the hind body and the punctuation—especially on the head and prothorax—considerably less close. The prothorax is not much less than twice as wide as long and its base is little more than a quarter again as wide as across the front; its hind angles are fairly well defined.

I refer to this species with some doubt two smaller specimens from the Blue Mountains, sent by Mr. Froggatt; they have the pygidium much more distinctly punctured and the general puncturation a trifle closer. The differences may possibly be sexual.

N.S. Wales.

HETERONYX ALPICOLA, sp.nov.

Sat elongatus; postice leviter dilatatus; subnitidus; ferrugineus antennarum clava dilutiori; pilis brevibus fulvis sat sparsim vestitus; capite rugulose sat crasse, prothorace pygidioque sat crebre vix fortiter, elytris, subfortiter subrugulose, punctulatis; labro clypeum (hoc antice rotundato reflexo) haud superanti; antennis 9-articulatis; unguiculis appendiculatis, unguiculorum posticorum parte basali quam pars apicalis multo longiori; coxis posticis metasterno paullo brevioribus. [Long. 3-$3\frac{1}{5}$, lat. $1\frac{1}{2}$-$1\frac{9}{10}$ lines

Also belongs to the group of *piceus*, owing to the combination of 9-jointed antennæ, clypeus free from labrum and not emarginate, hind claws normally appendiculate. The prothorax is about [illegible] again as wide as long, and at the base is not much more than [illegible] again as wide as across the front, which is not strongly bilobed, the base is feebly lobed in the middle; the front angles are not very prominent; the hind angles, viewed from above, are very well defined and nearly rectangular.

Victoria; on the higher mountains.

As the described species allied to *H. piceus* are now becoming rather numerous, it will perhaps be well to substitute the following tabulation for that falling under E (on 1st line of p. 1330, P.L.S.N.S.W., 1888):—

E. Clypeus not emarginate.
- F. Basal piece of hind claws evidently longer than the apical piece.
  - G. Upper surface not clothed with long erect hairs.
    - H. Sculpture of upper surface uniform (or nearly so) and more or less close and fine.
      - I. Front tibiæ strongly tridentate externally.
        - J. Sculpture (though uniform) considerably stronger than in the following two species .... **gracilipes*, Blackb.
        - JJ. Sculpture fine and close.
          - K. Size large, prothorax nearly twice as long as wide .... *piceus*, Blanch.

* These species were stated by me (in P.L.S.N.S.W., 1889, p. 1225) to be better placed near *H. piceus*, Blanch., than in the allied group (where I originally placed them), having the apical piece of the hind claws extremely short.

KK. Size medium, prothorax moderately transverse ... *terrena*, Blackb.

II. Uppermost tooth of front tibiæ scarcely defined ...... *pubescens*, Er.

HH. Sculpture of prothorax much more sparse than of head and elytra. .... **Victoris*, Blackb.

HHH. Sculpture of prothorax and elytra subequal; that of head much more coarse and rugulose.

I. Prothorax only very slightly narrowed anteriorly .... *incognitus*, Blackb.

II. Prothorax considerably narrowed anteriorly .... *alpicola*, Blackb.

GG. Upper surface clothed with long erect hairs .... *deceptor*, Blackb.

FF. Basal piece of hind claws not longer than the apical piece .... *Froggatti*, Mcl.

Heteronyx tridens, sp.nov.

Minus elongatus; sat convexus; postice sat dilatatus; sat nitidus; ferrugineus, antennis dilutioribus; pilis brevibus sparsim vestitus; capite crebre crasse rugulose, prothorace fortiter nec crebre, elytris crasse fortiter subcrebre, pygidio (hoc longe hirsuto) fortiter sat crebre, punctulatis; tibiarum anticarum dentibus externis validis; labro clypeum anguste minus fortiter superanti; antennis 8-articulatis; unguiculis appendiculatis; unguiculorum posticorum parte basali quam pars apicalis parum longiori. [Long. $4\frac{1}{5}$, lat. $2\frac{2}{5}$ lines (vix).

In many respects this species resembles *H. nasutus*, Blackb., (P.L.S.N.S.W., 1889, p. 147), the puncturation (except of the pygidium) and the remarkable structure and relation of the

* See note, *ante* p. 488.

clypeus and labrum being very similar. The following seem to be the points of difference from *H. nasutus*, clypeal suture not angulated, prothorax a little less transverse (about once and ⅔ as wide as long) and more narrowed anteriorly, hind coxæ very much shorter (nearly as short as the 2nd ventral segment), hind body (not "finely coriaceous" but) very nitid, basal piece of hind tarsi (not "exceptionally strongly" but) not in the least prominent at the apex.

In the tabulation of the sub-group of *Heteronyx* to which this species belongs (P.L.S.N.S.W., 1889) it falls under "GG" (near the end of p. 143) along with *H. auricomus*, Blackb., from which its clypeal suture not angular in the middle and the more sparse puncturation of its prothorax will, *inter alia*, distinguish it. The rather strong anterior narrowing of the prothorax approximates it to the species under "FF" (*anceps*, &c.); all those, however, have the labrum and clypeus quite differently related to each other except *Sloanei*, Blackb., in which these parts are a little (but not very much) similar, but in that species the prothorax is much more closely punctured.

W. Australia; Yilgarn; sent by C. French, Esq.

Heteronyx consanguineus, sp. nov.

Sat elongatus, sat convexus, postice leviter dilatatus; ferrugineus, antennis palpisque testaceis; pilis brevibus fulvis minus crebre vestitus; clypeo crebre parum rugulose, capite postice prothorace pygidioque subfortiter sat crebre vix rugulose, elytris crebre sat fortiter transversim rugulose, punctulatis, tibiis anticis externe sat fortiter 3-dentatis; labro clypeum parum late sat fortiter superanti, antennis 8-articulatis; coxis posticis metasterno multo brevioribus, unguiculis appendiculatis; unguiculorum posticorum parte basali quam pars apicalis paullo longiori; labro minus fortiter sat crebre ruguloso-punctulato.

[Long. $4\frac{4}{5}$, lat. $2\frac{2}{5}$ lines (vix).

The prothorax is about ⅘ again as wide as long and the base is about ⅔ again as wide as the front which is somewhat evenly and

[redacted]

moderately strongly emarginate, the base being but little lobed, the sides gently arched (their greatest divergence close to the base), the front angles sharp and moderately produced, the hind angles obtuse but fairly well defined. The underside is much like that of *H. punctipennis*, Blackb., except in being throughout more strongly and less closely punctured. This species belongs to Section III. of *Heteronyx*, and in the tabulation (P.L.S.N.S.W., 1889) would stand with *raucinasus* under "EE" near the end of p. 142. From that insect it differs by its much less strongly rugulose labrum, head and prothorax (the sculpture especially of the head behind the labrum being extremely different,—in *raucinasus* very coarse and close, and very strongly rugulose,—in *consanguineus* almost smooth, and consisting of isolated and but little crowded punctures scarcely differing from those of the prothorax), and by the very much more strongly marked clypeal suture.

Victoria; Alpine district.

HETERONYX NITIDUS, Blackb.

I have received from Mr. French another specimen (from Yilgarn) of this insect, the elytra of which are a little more strongly punctured than in the type,—so that the expression "*leviter* punctulata" could hardly be applied to those organs. As in the type the puncturation has the blurred appearance confused with transverse rugulosities which I mentioned as distinguishing it from the puncturation of *H. frontalis*. I think the type was an old specimen which had probably been dead some time when captured and that its puncturation was somewhat obliterated.

HETERONYX SETIFER, Blackb.

Among some specimens of *Heteronyx* from Yilgarn (sent by Mr. French) I find a single example which I should not like to separate from the S. Australian, and in my experience very rare, *H. setifer*. It is a little more sparsely punctured than the type (especially on the elytra), but I do not think it can be regarded as distinct.

HETERONYX PYGIDIALIS, Blackb.

Among the specimens of *Heteronyx* mentioned above is a much damaged specimen which belongs, I think, to this species.

HETERONYX PRODITOR, sp.nov.

Sat elongatus; postice leviter dilatatus; sat nitidus; obscure ferrugineus, antennis dilutioribus; pilis fulvis minus brevibus suberectis sat dense vestitus; capite elytris pygidioque sat sparsim, prothorace paullo magis sparsim, sat fortiter punctulatis; labro antice emarginato clypei superficiem vix attingenti nihilominus superne conspicuo; antennis 9-articulatis; coxis posticis metasterno multo brevioribus; unguiculis prope apicem obscure appendiculatis. [Long. $3\frac{1}{5}$, lat $1\frac{3}{5}$ lines.

This is one of the difficult species that seem to hover between the 2nd and 3rd sections of the genus, the labrum being prominent and turned upward just about to the level of the clypeus, but so shaped (emarginate in front) that from no point of view does the outline of the head present a trilobed appearance. It is not very close to any species known to me, but I think should be placed in the 2nd section in the neighbourhood of *H. diversiceps*, Blackb. In the tabulation of this section (P.L.S.N.S.W., 1889, pp 1230, &c., and there called "Group III.") it would fall under "F" (on page 1231) in company with *H. granum*, Burm., from which it differs *inter alia* by the very sparse puncturation of its prothorax. The prothorax is moderately transverse, about half again as wide as long, and is nearly twice as wide across the base as across the front margin; the sides are rather strongly rounded, being at their widest a little behind the middle; the base is strongly lobed, and the hind angles viewed from above appear as nearly right angles.

W. Australia; Yilgarn; sent to me by Mr. French.

HETERONYX BREVICORNIS, Blackb.

This species is also represented among the Yilgarn specimens mentioned above.

Rhopæa.

I have never seen a specimen that I can confidently affirm to be a female of this genus, although male examples are by no means rare. Germar states that the female of *R. heterodactyla* is distinguished by its short hind tarsi, and Burmeister adds that the club of its antennæ has only 6 joints (that of the male having 7), while Erichson states that the club of the *male* has 6 joints. There is no doubt that the antennal club has a different number of joints in the males of different species, so that it is possible that the male of one species may have been taken for the female of another. I have in my collection three examples which appear to belong to this genus and which I suspect may be females. They are from widely separated localities and pertain to three species. They differ from the males in being markedly smaller, and in having fewer joints in the antennal club and shorter tarsi, and also in being very much more coarsely and sparingly sculptured than any *Rhopæa* that I have seen and known to be a male. I should feel greatly indebted to any of my correspondents who could let me inspect a *Rhopæa* that can be positively affirmed to be a female.

Anoplognathus brevicollis, sp.nov.

Sordide brunneo-testaceus, capite prothoraceque certo adspectu cupreo purpureo tincto, hoc oculos versus viridimicanti, illo antice posticeque segmentis ventralibus postice scutello et elytrorum sutura anguste viridi-marginatis, tarsis posterioribus basin versus infuscatis; capite prothoraceque leviter subtilius sat crebre, elytris sat fortiter crebre vix lineatim, pygidio (hoc albido-piloso) crebre subtilius subsquamose, punctulatis; capite magno, antice inter oculos leviter biimpresso, sutura clypeali bene determinata; prothorace vix canaliculato, trans basin quam longiori multo plus duplo latiori, margine basali quam apicalis dimidio latiori, hoc leviter emarginato trisinuato, illo medio vix lobato, lobo postice leviter emarginato, lateribus a basi ad apicem arcuatim

convergentibus, angulis anticis sat acutis posticis sat acute rectis; elytris apicem versus externe denticulatis, hic illic obsolete costatis, disco ante apicem transversim tumido et denticulato, sutura in spina gracili producta; corpore subtus albido-piloso, mesosterno fortiter sat acute producto.

[Long. 11-12, lat. $6\frac{1}{4}$-$6\frac{1}{2}$ lines.

Maris clypeo antice sat fortiter sat anguste producto, tibiis anticis externe apicem versus bidentatis, dente altero minuto in medio instructis.

Feminæ clypeo antice rotundato, tibiis anticis externe tridentatis.

N.B.- Cujusdam ex exemplis femineis meis tibiæ anticæ externe subsimplices sunt.

The clypeus of the male narrows forward evenly for much more than half its length, and thence is almost parallel-sided, so that it is very much narrower across the apex than across the base; it scarcely differs from that of *A. Boisduvali*, Dup., except in having its front margin more arched; it also resembles the clypeus of *rugosus*, Kirby (male), but in that species the produced apex (*i.e.*, the piece beyond the level of where the sides cease converging forward) is evidently wider, shorter, and more truncate. The puncturation, sculpture, and pubescence are almost as in *A. Odewahni*, except that the pubescence is less dense in the specimens before me (possibly the result of abrasion), that the sutural apex of each elytron is produced into a slender and well defined spine about or nearly as long as the width of the lævigate space that runs down the elytron close to the suture, and that the external margin of each elytron for a short distance a little behind the middle has a fringe of well-defined sharp denticulations. The prothorax is unusually short in appearance owing to its base being scarcely lobed in the middle, but might rather be called "gently tri-sinuate"; in all, or nearly all, the other species of the genus the middle part of the base of the prothorax reaches a good deal further backward than the hind angles, but in this species the middle part is very nearly on a level with the hind angles; the prothorax thus being very small, the head appears proportionately

exceptionally large. All the claws are simple in both sexes. The transverse denticulate tumidity a little before the apex of the elytra renders this a very distinct insect.

N. Territory of S. Australia; taken at Burrundie by Dr. Bovill.

ANOPLOGNATHUS MACLEAYI, sp.nov.

Latus; robustus; minus convexus; pallide brunneus; capite prothoracis (hoc fusco-umbrato) elytrorumque marginibus scutello pygidio (hoc viridi-marginato) corpore subtus femoribus tibiis anticis tarsisque (abdominis segmentis postice plus minusve viridibus) subaureis; capite creberrime subtiliter (postice minus crebre), prothorace sparsim subtiliter, elytris minus sparsim minus subtiliter sublineatim (puncturis hic illic in striis subobsoletis positis), pygidio crebre rugulose parum subtiliter, punctulatis; prothorace quam longiori fere duplo (postice quam antice plus quam dimidio) latiori, margine antico vix bisinuato postico utrinque leviter late (in medio sat fortiter) emarginato, lateribus leviter arcuatis, angulis posticis subrectis; elytris singulis apice subacuminatis, lateribus apicem versus sinuatis; pygidio sat æqualiter albido-piloso; corpore subtus (sterni abdominisque parte media excepta) albido-piloso, mesosterni processu elongato acuto; tibiis anticis externe obtuse 3-dentatis.

Maris (?) clypeo antice rotundato-truncato leviter reflexo.

[Long. 13, lat. 7 lines.

I am doubtful of the sex of my type of this species; the extremely wide membranous interval between the apical and penultimate ventral segments points to its being a male, but the clypeus is more like that of a female. The species bears a good deal of resemblance to *A. Odewahni*, Macl.; compared with that species the prothorax is much less strongly bisinuate in front, has much more sharply defined hind angles and is much more strongly emarginate in the middle of the base, the elytra are much more dehiscent at the apex, the pygidium is less finely sculptured, the mesosternal process is much longer, &c.; also the colouring is quite different.

It is not improbable that this is the insect which Sir W. Macleay regarded as possibly the female of *A. Odewahni*. Both sexes of that species are known to me; the female differs from the male only by the characters that are usual in the genus.

S. Australia; basin of Lake Eyre.

BUPRESTIDÆ.

ASTRÆUS.

In P.L.S.N.S.W., 1889, there are descriptions of three new species of this genus from my pen. In the same year a monograph of *Astræus* by J. R. H. Neervoort van de Poll appeared in the "Tijdschrift Ent.," containing descriptions of new species. As might be expected the two clash, and it is clear to me that the species which I described as *A. Meyricki* and *A. Tepperi* were named by my colleague *A. Badeni* and *A. Jansoni* respectively. My *A. major* does not appear in the monograph, which also mentions (as did my paper) the identity of *A. Mastersi*, Macl., with *A. Samouelli*, Saund., and seems to indicate that *A. pygmæus*, Poll, is a good species and not (as I suggested to be possible) a var. of *Samouelli*.

MELOBASIS MONTICOLA, sp.nov.

Subtus ænea vix cuprascens, prosterno medio et abdomine antice viridescentibus, epipleuris antice aureo-cupreis; capite prothoraceque obscure cupreis; elytris nigro-æneis, sutura antice et maculis binis discoidalibus (altera fere ad medium altera sat longe ante apicem positis) læte aureo-cupreis; pedibus antennisque cyanescentibus; capite (hoc fere plano) creberrime rugulose, prothorace (hoc quam longiori fere duabus partibus, postice quam antice tertia parte, latiori) sat fortiter punctulatis; scutello lævigato, elytris sat fortiter striatis, striis subtilius punctulatis, interstitiis (præsertim alternis postice) nisi prope basin sat convexis, superficie magna pone humeros sat fortiter transversim rugata; corpore subtus fere glabro sat sparsim punctulato; prosterno antice declivi. [Long. $5\frac{1}{5}$-$5\frac{4}{5}$, lat. $1\frac{4}{5}$-$2\frac{1}{5}$ lines.

[redacted]

A rather wide depressed species, at its widest slightly behind the middle of the elytra. The puncturation of the head is closer than in any of the commoner species known to me of the genus (*e.g.*, *nervosa*, Boisd., *verna*, Hope); that of the prothorax is, in the male a little in the female much, less close and strong than in the corresponding sex of *M. verna;* the elytra are punctulate-striate almost as in *M. azureipennis*, Macl., (more distinctly than is usual in the genus), but the alternate interstices are markedly more convex in their hinder half than in that species; the sides of the prothorax are only very slightly arched (evidently less than in *M. verna*, Hope). On the underside the anteriorly declivous prosternum furnishes a distinction from many species of the genus, and the puncturation is unusually feeble throughout (much more so, *e.g.*, than in *M. nervosa*, Boisd.). Compared with the puncturation of the undersurface of *M. verna*, Hope (in the less closely-punctured sex,—male I think), that of the present species differs (besides being in all parts evidently less strong) on the prosternum in being very evenly distributed in the middle portion (not becoming coarser and rougher towards the front margin) and on the ventral segments in being almost evenly distributed, whereas in *verna* it becomes extremely sparse towards the middle line, especially on the intermediate segments.

In my example (which I take to be a male) the apical ventral segment has the subapical spine on either side very sharp and well developed, though much smaller than the apical spines; the apex of the segment is a kind of flat coriaceous plate, this plate being deeply and semicircularly emarginate quite through its substance (*i.e.*, the inner surface of the substance does not,—or scarcely,—project beyond the outer surface of the same), so that the margins of the emargination run out on either side in a strong free spine and the internal organs or the under surface of the substance of the dorsal segment is visible through the cavity of the emargination. In the corresponding sex of *M. verna* the inner surface of the substance of the ventral segment projects far beyond the outer surface, so that the emargination does not go *through* the substance, and the lateral spines (which also are

really shorter) have very little free projection; the emarginate part of the segment, moreover, is not flattened or otherwise distinguished from the general surface

I have seen an example belonging to Mr. French, of Melbourne, which I have no doubt is the female of this insect (though the golden coppery spots on the elytra are reduced to a single transverse blotch on the disc about at its middle longitudinally); it differs on the undersurface in the punctures being throughout evidently *larger*, though scarcely more numerous or more strongly impressed, in the subapical spines being scarcely marked and in the apical emargination being much wider and feebler with the inner surface of the substance much more produced, so that the emargination goes *through* the substance only in its hinder portion, and the free projection of its lateral spines is less. On the upper surface the colour (of this example) is greenish-black, very nitid (as in the male), and the punctures in general differ a little, in the same way as on the undersurface.

I do not feel quite satisfied that this may not be a very small Alpine race of *M. superba*, Hope, with the golden colouring much reduced, but even in that case it seems to call for a distinctive name.

Victoria; my example was taken near the summit of one of the higher mountains.

Melobasis rotundicollis, Blackb.

A recent revision of the species of *Melobasis* in my collection has suggested a doubt whether this species may possibly be identical with *M. viridi-obscura*, Thoms., *obscurella*, Thoms., or *simplex*, Germ. The descriptions of those species are too brief to be applied confidently to any insect without a comparison of types, but they are all about the same size as *rotundicollis*, and coloured more or less like some of its vars.; the description of the puncturation, however, does not agree very well. As regards *simplex*, however, I have another *Melobasis* which I think still more likely to be it. *M. rotundicollis* differs from all its near allies (apart from the characters I mentioned when describing,

Trans. Roy. Soc., 1887, p. 241) by the presence on the elytra of a large space round the scutellum on which the longitudinal direction of the elytral sculpture absolutely ceases. Its sexual distinctions are not very strongly marked ; in the male the apical emargination of the last ventral segment is a little narrower and deeper than in the female, and its lateral spines are a little stronger ; also the intermediate tibiæ are slightly arcuate and a little shorter and stouter than in the female.

MELOBASIS BELTANENSIS, sp.nov.

♂. Viridis, elytris cupreo-purpureis exceptis (colore sine dubio variabili) ; capite (sat plano æquali) confertim aspere, prothorace sat crebre sat fortiter (latera versus vix magis crasse), elytris subfortiter sat æqualiter, corpore subtus fortiter fere æqualiter, punctulatis ; prothorace quam longiori fere tribus partibus latiori, antice leviter angustato, lateribus leviter rotundatis ; elytris leviter striatis, striis antice et latera versus obsoletis, interstitiis nonnullis (præsertim 2ª 4ªque) nonnihil convexis; prosterno antice declivi; tibiis intermediis sat brevibus, sat robustis, leviter arcuatis; segmento ventrali apicali 4-spinoso et in medio semicirculariter inciso.

[Long. $3\frac{3}{5}$, lat. $1\frac{3}{5}$ lines (vix).

A very distinct little species remarkable for the evenness of its puncturation, especially on the underside where the basal ventral segment is (even in front) not punctured noticeably less closely and strongly than the other segments ; the even and well-marked puncturation of the elytra, too, is very characteristic. The apical emargination of the last ventral segment and the apical spines are fairly strong ; on either side there is a strong tooth (doubtless absent in the female) a little behind the apex.

S. Australia ; near Beltana, on the border of the interior desert region.

STRIGOPTERA.

Mr. C. French, of Melbourne, has lately forwarded for my inspection an insect which he tells me was named for him some time ago by M. Deyrolle as *Strigoptera Frenchi*. I have in my

collection several species evidently congeneric with it, which, however, I had not ventured to attribute to this genus on account of their scutellum being of a form different from that which M. Lacordaire attributes to *Strigoptera* (stated by him to be identical with *Castalia*). In these species it is very small and more or less transverse instead of in the form of a very elongate triangle. On M. Deyrolle's authority, I think I may treat them as *Strigoptera* without danger of serious error. As I cannot find that *S. Frenchi* has been described, I give a short description of it below.

STRIGOPTERA FRENCHI, sp.nov. (?).

Elongata; minus convexa, elytris pone medium sat dilatatis; nitida; supra cupreo-æneа, latera versus aureo-cupreo micans; corpore subtus pedibusque violaceis, illo hic illic viridi-micanti; capite sat fortiter crebre punctulato, longitudinaliter postice subtiliter impresso, inter oculos transversim late arcuatim subimpresso et mox ante partem impressam tumido vel subtuberculato; prothorace fortiter rugulose punctulato, medio in parte postica canaliculato quam longiori vix plus quam dimidio latiori, postice quam antice circiter quarta parte latiori, margine antico basique leviter bisinuatis, lateribus leviter arcuatis, latitudine majori paullo pone medium posita, angulis posticis acute rectis; scutello lævi (exempli visi viridi); elytris singulis costis 4 obscuris irregularibus instructis interspatiis sat crasse sat rugulose confuse punctulatis, lateribus (his retrorsum gradatim magis late marginatis) pone humeros sinuatis, postice subtiliter crenulatis, apice anguste oblique truncato, sutura ad apicem breviter spinosa; corpore subtus sat sparsim (prosterno magis crebre) minus fortiter punctulato; segmento ventrali apicali postice producto, ad apicem truncato, truncatura utrinque leviter angulato-producta; segmentis ventralibus 4 ad latera fossa profunda rotunda utrinque impressis. [Long. 8, lat. 3 lines.

Very distinct from all other Australian *Buprestidæ* known to me.

Victoria; mountains of Gippsland.

STRIGOPTERA AUSTRALIS, sp.nov.

Valde elongata; minus convexa; elytris pone medium leviter dilatatis; sat nitida; tota læte violacea plus minusve cupreomicans; capite sat æqualiter convexo, inter oculos vix planato crebre rugulose punctulato; prothorace longitudinaliter canaliculato (canali postice profundo antrorsum gradatim magis obsoleto, marginem anticum haud attingenti), sat fortiter minus crebre haud rugulose (latera versus magis crebre magis rugulose) punctulato, quam longiori fere duabus partibus latiori, postice quam antice circiter quarta parte latiori, antice posticeque leviter bisinuato, lateribus modice arcuatis, latitudine majori circiter in medio posita, angulis posticis obtusis, scutello longitudinaliter impresso; elytris singulis costis 6 (sutura margineque laterali inclusis) bene determinatis insignibus, costa suturali antice extrorsum oblique directa, costa submarginali antice obsoleta, interstitiis fortiter sub reticulatim rugulosis, lateribus pone humeros sinuatis postice haud (vel vix perspicue) crenulatis, apice sat rotundatis; corpore subtus fere ut præcedentis punctulato et segmentis ventralibus vix diversis nisi foveis lateralibus haud vel vix perspicuis. [Long. 7½-8½, lat. 2½-3 lines.

Also a very distinct species. I possess an example which seems to differ from the above only in being much larger (Long. 10½ lines) and having the ventral segments coriaceous and more finely and deeply punctured; it is probably a female.

S. Australia; Yorke's Peninsula.

STRIGOPTERA MARMORATA, sp.nov.

Valde elongata; depressa; elytris pone medium sat fortiter dilatatis; supra subopaca nigra, elytris flavo-maculatim 5-fasciatis; corpore subtus pedibusque æneis subnitidis; capite planato, crebre rugulose punctulato, breviter pallide hirto; prothorace inæquali (in medio longitudinaliter late profunde et utrinque minus distincte, sulcato), inæqualiter rugulose punctulato, partibus depressis opacis creberrime—partibus

elevatis magis nitidis sat sparsim—sat transverso, antice sat fortiter angustato, lateribus modice arcuatis, angulis posticis rectis; scutello in medio impresso, elytris singulis costis 6 (sutura margineque laterali inclusis) et altera abbreviata scutellari nitidis subflexuosis instructis, interstitiis in partibus nigris reticulatim sat fortiter (in partibus flavis vix perspicue) rugulosis, lateribus pone humeros parum sinuatis, apice truncato et breviter multidentato; corpore subtus fortiter punctulato; segmento ventrali basali antice longitudinaliter concavo, segmento apicali fere ut *S. frenchi* sed minus fortiter producto et utrinque in margine laterali dente parvo acuto armato. [Long 10, lat. 3¼ lines.

A very remarkable *Buprestid* and quite unlike any other known to me. The structure of its under surface,—especially the relation of the sterna *inter se* and the form of the apical segment,—together with the general form, however, is so much in agreement with *S. australis* that I think the two species ought not to be far separated. The yellow blotches on the elytra are arranged in five fasciæ which occupy altogether a larger space than the black portions; of these fasciæ the anterior two are not very distinct *inter se*; the two costæ preceding the margin are abbreviated in front and are connected with each other a little behind the shoulder; they are also connected (as is the 2nd with the 1st) a little before the apex.

S. Australia; I do not know the exact habitat.

EUCNEMIDÆ.

DROMÆOLUS INTERIORIS, sp.nov.

Sat elongatus; sat cylindricus; obscure brunneus; pube subtili fulva vestitus; capite prothoraceque crebre fortiter rugulose nec grosse punctulatis; illius clypeo in medio haud marginato, fronte longitudinaliter carinata; prothorace quam latiori haud longiori, canaliculato, canali antice abbreviato, lateribus parallelis, angulis posticis acutis retrorsum modice productis; elytris striatis, interstitiis sat planis rugulosis; antennis apice sat acuminatis, articulo ultimo præcedenti æquali; corpore

[redacted]

subtus crebre rugulose (prosterno minus crebre magis crasse) punctulato. [Long. $4\frac{2}{3}$, lat. $1\frac{1}{3}$ lines.

Near *D. lugubris*, Bonv., but *inter alia* differently coloured, the underside, *e.g.*, being (not "black" but) dark reddish-brown, and having the prothorax not at all dilated near the front.

S. Australia; basin of Lake Eyre.

LYCAON EXPULSUS, Bonv.

I have before me an example which I took under bark of *Eucalyptus* on one of the Australian Alps in Victoria, and which appears to be this species although differing (sexually I think) in antennal structure from the type; joints 4-8 being almost equal *inter se* (4 and 7 slightly the longest of them), joint 9 equal to 6-8 together, 10 narrower than 9, scarcely so long, 11 as narrow as 10 and longer than 9.

ELATERIDÆ.

LACON BRIGHTENSIS, sp.nov.

Opacus; nigro-fuscus, antennis pedibusque obscure rufescentibus; obscure squamosus; capite prothoraceque crebre sat fortiter punctulatis; illo subplano vix æquali; hoc vix transverso, minus convexo, late obsolete canaliculato, foveis 4 in disco impresso, basi quam margo anticus duplo latiori, lateribus obsolete crenulatis antice rotundatis postice vix sinuatis, angulis posticis rectis intra marginem carinatis; elytris quam prothorax vix latioribus vix duplo longioribus, sat depressis, vix striatis, striis distincte sat fortiter nec crebre punctulatis, sutura et interstitio 6° totis (interstitiis 2° 4° que postice) convexis, angulis humeralibus subrectis; sulcis tarsorum in prosterno sat angustis bene determinatis, in metasterno sat distinctis. [Long. $3\frac{1}{2}$-4, lat. $1\frac{1}{3}$-$1\frac{2}{3}$ lines.

To the eye the elytra appear decidedly, but when measured they are found to be scarcely, less than twice as long as the prothorax. The four rather deep and conspicuous foveæ placed as the corners of a square on the disc of the prothorax are a well-marked character.

In Dr. Candèze's tabulation of *Lacon* [Mém. Liège (2) IV.] this species would fall I think beside *L. sculptus*, a much larger and very different species. If it were placed among the species having the elytra at least twice as long as the prothorax, it would fall beside *L. variabilis*, Cand., also much larger and in other respects very different.

Victoria; near Bright, under bark of *Eucalyptus*

LACON MURRAYENSIS, sp.nov.

Modice elongatus; parum nitidus: setis brevibus fulvis sparsim vestitus; rufo-brunneus, nigro-marmoratus; capite prothoraceque sat crasse sat crebre punctulatis; illo antice planato convexo, hoc quam longiori paullo latiori subdepresso, obscure canaliculato, postice quam antice fere duplo latiori, lateribus subcrenulatis, a basi ultra medium fere rectis, angulis posticis rectis (exemplis nonnullis apice summo minute truncato) intra marginem subtuberculatis; elytris quam prothorax vix latioribus vix duplo longioribus, subdepressis minus distincte punctulato striatis, puncturis quadratis, interstitiis sat æqualibus sat angustis (exemplis nonnullis leviter subcarinatis), angulis anticis rectis; tarsorum anticorum sulcis bene determinatis intermediorum fere obsoletis.

[Long. 4-$4\frac{1}{4}$, lat. $1\frac{1}{5}$-$1\frac{3}{5}$ lines.

In colour and markings resembling *L. variolus*, Cand., beside which it would fall in the tabulation (referred to above) but differing *inter alia* in its sharply defined anterior tarsal sulci. In general form and sculpture much resembling *L. variabilis*, Cand., but with shorter elytra, equal elytral interstices, different tarsal sulci, &c. The distinct though ill-defined sulci for the intermediate tarsi will distinguish it from most of its congeners.

S. Australia; near Murray Bridge.

LACON LINDENSIS, sp.nov.

Minus latus; subparallelus; sat nitidus; setis brevibus pallidis minus crebre vestitus, niger, prothoracis lateribus (præsertim ad angulos) antennis pedibusque rufescentibus; corpore sub-

tus sat opaco piceo, prosterno antice rufescenti, elytrorum epipleuris antice et prosterni angulis posticis plus minusve læte testaceis; capite sat plano crasse punctulato; prothorace quam latiori vix longiori, postice quam antice duabus partibus latiori, minus convexo, sat fortiter canaliculato, fortiter minus crebre punctulato, disco 4-foveolato, lateribus subtiliter crenulatis a basi ultra medium fere parallelis, angulis posticis acute rectis, intra marginem carinatis; elytris quam prothorax vix latioribus vix duplo longioribus, minus convexis, seriatim grosse punctulatis, interstitiis nonnullis (retrorsum gradatim magis fortiter) carinatis et hic illic carinis transversis conjunctis, angulis humeralibus subrectis; tarsorum anticorum sulcis bene determinatis, intermediorum subobsoletis.

[Long. $2\frac{4}{5}$, lat. 1 line.

Much like *L. lacrymosus*, Cand., but much more nitid; that species is stated to be "opacus." I think I have identified *L. lacrymosus* with tolerable certainty, although the description is very defective, giving no information, *e.g.*, as to the tarsal sulci. Compared with that insect, the present one, besides being much more nitid, is considerably smaller and narrower, with more elongate elytra, the carinate interstices of which (though growing more carinate near the apex) are not tuberculate; also the colour is different,—the testaceous colour of the epipleuræ and underside of the prothoracic hind angles being conspicuous and apparently constant; the prothorax is less closely punctured and the tarsal sulci of the prosternum are very much more sharply defined (being not much less so than in *L. caliginosus*, Guér.); in both species the tarsal sulci of the metasternum are distinctly indicated.

South Australia; not rare near Port Lincoln, under bark of *Eucalyptus*.

LACON ADELAIDÆ, sp.nov.

Minus latus; sat nitidus; sat convexus; setis minutis testaceis sat sparsim vestitus; niger, antennis (articulo basali excepto) prosterno antice pedibusque (femoribus tibiisque plus minusve infuscatis) rufo-testaceis; capite prothoraceque fortiter sat

crebre nec rugulose punctulatis; illo subplanato medio triangulariter vix impresso; hoc quam latiori vix longiori, postice quam antice plus quam dimidio latiori, obsolete canaliculato, ad angulos anticos late impresso, lateribus integris antice sat rotundatis pone medium sinuatis, angulis posticis acutis retrorsum productis intra marginem carinatis; elytris quam prothorax nullo modo latioribus vix duplo longioribus, sat grosse seriatim punctulatis, interstitiis alternis angustis sat distincte elevatis, angulis humeralibus minute dentiformibus; tarsorum anticorum sulcis sat magnis male definitis, intermediorum vix distinctis. [Long. $2\frac{1}{2}$, lat. 1 line.

The general nonparallel outline of this small species is much like that of *L. divaricatus*, Cand., the prothorax being rounded and markedly wider at or in front of the middle than at the base, and the elytra being narrow at the base and dilating hindward. In the tabulation of *Lacon* (referred to above), this insect would fall among the last six species; if the dentiform humeral angles can be relied on as constant, this character distinguishes it from them all; if not it would fall beside *L. carunculatus*, from which it differs by its pale antennæ and legs, the alternate interstices of its elytra by no means strongly carinate, the larger tarsal sulci of the prosternum, as well as smaller size. In this species one of the elevated interstices (the 5th interstice, including that next the suture) is decidedly more elevated than any of those nearer the suture.

S. Australia; near Adelaide.

LACON DUPLEX, sp.nov.

Minus latus, sat nitidus; sat convexus; setis minutis testaceis sat sparsim (in elytris seriebus obscure geminatis) vestitus; piceo niger, prosterno antice tibiis tarsisque dilutioribus, exempli cujusdam elytris antice testaceis; capite prothoraceque fere ut *L. Adelaidæ* sed hoc ad angulos anticos minus distincte impresso, angulis posticis subrectis vix retrorsum productis intra marginem vix carinatis; elytris quam prothorax vix latioribus duplo longioribus, sat fortiter sat crebre

[redacted]

seriatim punctulatis, striatis, interstitiis inter se æqualibus vix convexis, angulis humeralibus vix acutis ; tarsorum anticorum sulcis sat angustis sat bene determinatis, posticorum subobsoletis. [Long. 2 (vix), lat. $\frac{3}{5}$ line.

The smallest Australian *Lacon* yet described. Perhaps nearest to *L. Victoriæ*, Cand., but smaller and narrower and with no difference between the punctures in the striæ and interstices of the elytra, also the prothorax less closely and not at all rugulosely punctured. The dark antennæ will distinguish this species from many of its allies.

Victoria ; in the western districts.

LACON EUCALYPTI, sp.nov.

Minus latus; minus nitidus; sat convexus; setis brevibus cinereis æqualiter sat crebre vestitus; piceo-niger, prothoracis angulis prosterno antice antennis pedibusque rufis; capite prothoraceque crebre minus grosse punctulatis; illo subplanato in medio impresso; hoc quam longiori vix (postice quam antice minus quam duplo) latiori, leviter canaliculato, ad angulos anticos haud impresso, lateribus crenulatis antice arcuatis a basi ultra medium fere parallelis, angulis posticis sat acute rectis retrorsum vix productis intra marginem lateralem vix perspicue carinatis; elytris pone medium leviter dilatatis, quam prothorax paullo latioribus plus quam duplo longioribus, punctulato-striatis, interstitiis planatis æqualibus quam striæ paullo minus crebre magis subtiliter punctulatis, angulis humeralibus subobtusis nullo modo rotundatis; tarsorum anticorum sulcis angustis bene determinatis, intermediorum sat distinctis. [Long. $2\frac{1}{2}$-$2\frac{4}{5}$, lat. $\frac{4}{5}$-1 line.

A small species nearly allied to several preceding, but distinguished by elongate elytra (which are evenly punctulate-striate), close puncturation of prothorax (which is not at all foveate within the anterior angles), and strongly defined tarsal sulci, those of the metasternum particularly being very well (though much less so than in *L. caliginosus* and its allies) defined.

S. Australia ; under bark of *Eucalyptus* near Port Lincoln.

Lacon andersoni, sp.nov.

Minus latus; sat nitidus; sat convexus; setis minutis fulvis sat sparsim vestitus, piceo-niger, prosterno antice pedibusque dilutioribus; capite prothoraceque sat grosse minus crebre (præsertim in hujus disco) punctulatis; his in ceteris rebus fere ut *L. Adelaidæ*, prothorace nihilominus intra angulos posticos minus perspicue carinatis; elytris fere ut *L. Eucalypti* sed minus elongatis, angulis humeralibus fere subspiniformibus; tarsorum anticorum sulcis sat bene determinatis, posticorum subobsoletis. [Long. $2\frac{1}{2}$, lat. 1 line (vix).

Very like *L. duplex*, but *inter alia* larger, with the prothorax much less closely punctured, and the punctures of the striæ on the elytra quite distinct from those of the interstices; differing from *Eucalypti* by the sparser prothoracic sculpture, subdentiform humeral angles, dark antennæ, &c., &c.

S. Australia; near Port Lincoln.

Lacon victoriæ, Cand.

I am not quite sure that I am right in referring to this species a small *Lacon* occurring near Melbourne and agreeing very fairly with the description in every respect except the colour of its antennæ, which is red, whereas the description implies (without very distinctly asserting it) that *L. Victoriæ* has black antennæ I, however, think the identification sufficiently probable to justify me in referring to the insect in question (in the following tabulation) as *L. Victoriæ*. This tabulation includes the new species described above together with two or three old species which from their size, general appearance, and habitat it seems well to distinguish from them.

A. Upper surface not reddish marbled with black.

B. Tarsal sulci distinct on the metasternum.

C. Elytral interstices equal.

D. Antennæ testaceous.

E. Form narrow and elongate *L. Eucalypti.*

EE. Form wider and shorter... *L. Victoriæ*, Cand.

DD. Antennæ piceous or black.

E. Prothoracic puncturation sparse, humeral angles subdentiform .... *L. Andersoni.*

EE. Prothoracic puncturation rather close, humeral angles normal.

F. Size extremely small. .... *L. duplex.*

FF. Size much larger......... *L. humilis*, Er.

CC. Elytral interstices unequal.

D. Opaque species.

E. The 3rd and 5th interstices scarcely elevated in their front half .... *L. brightensis.*

EE. These interstices elevated throughout their length *L. lacrymosus*, Cand.

DD. Nitid species.

E. Disc of prothorax 4-foveolate *L. lindensis.*

EE. Disc of prothorax not 4-foveolate .... *L. Adelaidæ.*

BB. Tarsal sulci not marked on the metasternum .... *L. divaricatus*, Cand.

AA. Upper surface reddish, marbled with black .... *L. Murrayensis.*

MONOCREPIDIUS RUFICOLLIS, sp.nov.

♂. Angustus; elongatus; obscure fulvo-pubescens; ater, prothoracis disco toto sanguineo, prosterno metasternoque mediis et tarsis obscure rufescentibus; prothorace quam longiori vix (trans angulos posticos) angustiori, a basi ad apicem sat

fortiter angustato, in medio longitudinaliter sat fortiter canaliculato, subtilius minus crebre punctulato, angulis posticis parum divergentibus sat elongatis bicarinatis (carina interna brevi subtilissima); elytris apice obscure emarginatis, striatis, striis subtiliter punctulatis, interstitiis leviter convexis subtilius subcrebre subaspere punctulatis, corpore subtus (prosterno in medio minus crebre subfortiter punctulato excepto, hoc ad latera haud sulcato) creberrime subtiliter punctulato; antennis metasterni medium fere attingentibus, articulo 3° quam 2^{us} duplo longiori; tarsorum lamella sat lata.

[Long. $5\frac{2}{3}$, lat. $1\frac{1}{2}$ lineæ.

A very elongate species, distinguished from nearly all its congeners by its bright well-defined colouring. In Dr. Candèze's tabulation of the species of *Monocrepidius* (Mon. des Elat., vol. ii.) I am doubtful whether it would be placed among the species with the posterior angles of the prothorax bicarinate (page 195) or among those (page 196) in which the angles have only a single [redacted]

postice subparallelo antice modice angustato, postice in medio leviter canaliculato, creberrime subrugulose (in femina quam in mare paullo minus crebre) punctulato, angulis posticis vix perspicue divergentibus sat elongatis sat fortiter bicarinatis; elytris apice vix emarginatis, leviter striatis, striis distincte nec crebre punctulatis, interstitiis subplanis subtiliter crebre subaspere punctulatis; corpore subtus subtiliter creberrime (prosterno in medio magis fortiter magis sparsim punctulato excepto, hoc ad latera haud sulcato) punctulato; antennis prothoracis basin (maris sat fortiter feminæ vix) superantibus, articulo 3° quam 2^{us} duplo longiori; tarsorum lamella sat lata; capite postice in medio longitudinaliter sat fortiter carinato. [Long. $3\frac{3}{5}$-$6\frac{1}{5}$, lat. 1-2 lines.

An obscure and inconspicuous looking species varying greatly in size and more or less in colour (these variations are, I think, almost universal in the Australian *Monocrepidii*). Its chief reliable characters seem to be the comparatively strong carina on the head, the very close asperate puncturation of the prothorax (especially in the male), the slightness of the narrowing of the prothorax, except quite near the front (making the segment appear less elongate than it really is), and the uniformly pitchy-black colour of the upper surface combined with entirely testaceous legs. The distinctly testaceous colour of the apex of the abdomen also seems constant, though more conspicuous in some examples than in others. The elytral interstices are distinctly transversely strigose. In Dr. Candèze's tabulation of *Monocrepidius* (referred to above under *M. ruficollis*) this species would fall beside *M. rectangulus*, from which *inter alia* its much smaller size, posterior prothoracic angles not quite so absolutely non-divergent, and more elongate prothorax, will at once distinguish it.

Victoria; Alpine district.

MONOCREPIDIUS ALPICOLA, sp.nov.

Modice elongatus; nitidus; obscure fulvo-pubescens; supra niger, scutello et corpore subtus rufo-ferrugineis (sternis et abdominis basi nonnullis exemplis obscurioribus), antennis

palpis pedibusque testaceis; prothorace quam longiori vix (trans angulos posticos) latiori antrorsum a basi modice arcuatim angustato, postice in medio sat fortiter canaliculato, subtilius minus crebre (in femina quam in mare paullo magis crebre) punctulato, angulis posticis parum divergentibus sat elongatis bicarinatis (carina interna subtili); elytris apice vix perspicue emarginatis, striatis, striis sat fortiter sat crebre punctulatis, interstitiis vix planis crebre subrugulose punctulatis basin versus fere granulatis; corpore subtus ut *M. frontalis* punctulato, prosterno ad latera sulcato; antennis prothoracis basin (maris vix, feminæ haud) attingentibus, articulo 3° quam 2^{us} parum longiori; tarsorum lamella minus lata, capite postice in medio longitudinaliter sat fortiter carinato. [Long. 4-4½, lat. 1⅓-1⅔ lines.

A rather inconspicuous species distinguishable by its short antennæ, bright ferruginous scutellum in contrast with the nearly black general surface, prothoracic puncturation less close (especially in the male) than in many *Monocrepidii*, prothorax scarcely so long down the middle as it is wide across the apices of the hind angles, strongly carinated head, strong fold on either side of the prosternum (where the margin of the prothorax laps over as in *M. Jekeli*, Candèze, &c.), and comparatively narrow tarsal lamella. In Dr. Candeze's tabulation, referred to above, this species would (on account of its prosternal structure) fall beside *M. Brucki* and *Jekeli*; of these the former is one of the largest species in the genus,—the latter is at once distinguished from the present insect by its antennæ being "very long." Among the species described since the publication of Dr. Candèze's monograph, *M. nitidulus*, Cand. (from N.S. Wales), alone seems to come very near this insect,—but *inter alia* as the learned author does not refer to its prosternum being sulcate laterally it may be presumed that it is normal in structure.

Victoria; Alpine district.

Monocrepidius macleayi, sp.nov.

Robustus, minus elongatus, postice sat fortiter angustatus, sat crebre fulvo-pubescens; ferrugineus, elytris basi summa

[redacted]

scutello abdominisque apice rufis, capite prothoraceque obscurioribus, pedibus testaceis; prothorace quam longiori trans angulos posticos sat latiori, a basi antrorsum gradatim nec fortiter angustato, longitudinaliter canaliculato, confertim rugulose punctulato, angulis posticis haud divergentibus sat elongatis fortiter bicarinatis; elytris apice rotundatis, sat fortiter punctulato-striatis, interstitiis planis leviter minus distincte punctulatis; corpore subtus subtiliter sat crebre (prosterno in medio fortius subrugulose punctulato excepto, —hoc ad latera sulcato) punctulato; antennis (feminæ?) prothoracis basin haud plane attingentibus, articulo 3° quam 2^us^ fere duplo longiori; tarsorum lamella sat angusta; capite postice in medio longitudinaliter sat fortiter carinato.

[Long. 6½, lat. 2 lines (vix).

I have only a single example of this species and am not quite sure of its sex, but suspect it is a female. On a casual inspection it looks much like a female of *M. Australasiæ*, Boisd., from which however it differs totally by the narrowness of its tarsal lamellæ and the sides of the prosternum being sulcate as in *M. Jekeli* and other species. It also differs from *Australasiæ* (female) in being of shorter build and comparatively wider in the middle, with the elytra gently narrowing hindward almost from the base; also the prothorax is more transverse (being by measurement decidedly wider across the hind angles than it is long down the middle), its hind angles are not divergent otherwise than as involved in their evenly continuing the sides which diverge slightly hindward, and its median channel is traceable quite to the front; also the prosternum is more closely and rugulosely punctured in the middle,—otherwise the sculpture is not very different.

In Dr. Candèze's tabulation (referred to above) this species would fall beside *M. fictus*, on page 241; passing over differences that might possibly be sexual, it seems to differ from *M. fictus* in the apex of the elytra being quite devoid of emargination and in their extreme base being marked with red.

Victoria; Alpine district.

MONOCREPIDIUS OVENSENSIS, sp.nov.

Angustus subparallelus; minus nitidus; supra læte maculatim albido-pubescens; piceus; capite, prothoracis elytrorumque lateribus, illius media parte, horum basi, scutello et tarsis apicem versus rufescentibus; prothorace quam longiori vix (trans angulos posticos) angustiori, antrorsum a basi angustato, leviter (antice vix perspicue) canaliculato, sat crebre minus fortiter punctulato, angulis posticis haud divergentibus, sat elongatis, sat fortiter bicarinatis; elytris apice subacuminatis, punctulato-striatis, interstitiis sat planatis sat crebre subrugulosis; corpore subtus confertim subtiliter (prosterno sparsius fortius, hoc ad latera haud sulcato) punctulato; antennis prothoracis basin haud plane attingentibus, articulo 3° quam 2° sat longiori; tarsorum lamella sat angusta; capite postice haud distincte carinato.

[Long. $4\frac{1}{2}$, lat. $1\frac{1}{8}$ lines.

Very distinct from all previously described species through the whitish pubescence of the upper surface arranged among some dark brown pubescence in such fashion as to form a number of whitish spots which on the prothorax are very ill-defined but on the elytra very clearly defined and there arranged so as to fall into about 10 transverse fasciæ. It appears to be a typical *Monocrepidius* in all its structural characters. It may be noted that owing to the gradual narrowing forward of the prothorax that segment has the appearance of being more elongate than it really is.

Victoria; Alpine district.

MONOCREPIDIUS BALDIENSIS, sp.nov.

Angustus, sat parallelus; minus nitidus; supra dense cinereo pubescens; piceus, prothoracis angulis posticis, scutello, sutura, genubus, tarsis, abdominisque apice, rufescentibus; prothorace quam trans angulos posticos latiori paullo longiori, a basi antrorsum leviter angustato, haud canaliculato, crebre subrugulose punctulato, angulis posticis haud divergentibus

[redacted]

sat elongatis sat fortiter bicarinatis; elytris apice singulatim acuminatis, punctulato-striatis, interstitiis sat planis subtiliter rugulosis; corpore subtus subtiliter crebre (prosterno fortius subrugulose,—hoc ad latera haud sulcato) punctulato; segmentis ventralibus ad latera transversim profunde foveatis; antennis prothoracis basin superantibus, articulo 3° quam 2^{us} paullo longiori; tarsorum lamella minus lata; capite postice in medio vix distincte carinato. [Long. 5, lat. $1\frac{1}{5}$ lines.

The whitish-ashy pubescence is so close on the upper surface as to much conceal the sculpture. The foveæ on the sides of the ventral segments are larger and deeper than is usual in this genus. The very elongate appearance of the prothorax, in combination with the close pubescence, the red scutellum and suture, the elongate parallel general form, and the dark colour of the antennæ and legs will render this species easily recognisable.

I hardly know where it should be placed in Dr. Candèze's tabulation of *Monocrepidius*, as the width of the tarsal lamellæ is such as to render it of doubtful reference to either the group with wide or with narrow lamellæ. The hind angles of the prothorax diverge only to the extent of being in even line with the sides of the same.

Victoria; Alpine district.

The above species of *Monocrepidius* may be thus tabulated:—

A. Sides of prosternum normal.
  B. Elytra unicolorous and without pubescent markings.
    C. Elytra black, disc of prothorax bright red..... *ruficollis.*
    CC. Elytra and prothorax concolorous or nearly so.. *frontalis.*
  BB. Elytra piceous, with the suture red............. *Baldiensis.*
  BBB. Elytra with whitish pubescence forming a well defined pattern .... *Ovensensis.*
AA. Sides of prosternum sulcate.
  B. Prothorax extremely closely punctulate........... *Macleayi.*
  BB. Prothorax much less closely punctulate......... *alpicola.*

CARDIOPHORUS VICTORIENSIS.

Niger, prothorace (fascia basali antrorsum arcuata sat angusta nigra excepta) tarsisque rufo-testaceis; pube brevi suberecta sat dense vestitus; prothorace quam longiori vix latiori, crebre subtiliter sat æqualiter punctulato, antice minus angustato, lateribus fere ad apicem marginatis parum rotundatis, elytris quam prothorax vix latioribus sat fortiter punctulato-striatis, interstitiis sat planis crebre obscure subrugulosis; unguiculis intus late subobsolete dentatis, antennis robustis prothoracis basin longe superantibus.

[Long. 2⅖, lat. ⅘ line.

Probably near to *C. bicolor*, Cand., which however *inter alia* is a smaller species, with testaceous legs. The example described is probably a male.

Victoria; Alpine district.

CARDIOPHORUS EUCALYPTI, sp.nov.

Niger, antennarum basi tarsisque testaceis, tibiis brunneis vel obsure testaceis, elytrorum parte basali tertia brunneo-testacea, colore hoc latera versus nonnullis exemplis retrorsum producto; pube brevi suberecta sat dense vestitus; prothorace subtilissime vix perspicue punctulato, antice sat fortiter angustato, latitudine longitudini æquali, lateribus fortiter rotundatis pone medium subsinuatis a basi ultra medium subtiliter marginatis; elytris quam prothorax haud vel vix latioribus, minus fortiter punctulato-striatis, interstitiis vix convexis obscure punctulatis; unguiculis intus late obtuse dentatis; antennis (♂) prothoracis basin longe superantibus vel (♀) multo brevioribus. [Long. 2½, lat. ⅘ line (vix).

It may be observed that it is just possible this may be a form of *C. elisus*, Cand., with an extreme development of the humeral red colour. But if so it is desirable that it should be described, and it certainly seems to deserve a distinctive name even as a var. I have seen nothing at all intermediate between the two forms.

Victoria; under bark of *Eucalyptus* in the Alpine district; also in S. Australia.

MALACODERMIDÆ

Helodes.

The following species have quite the facies of the European species of this genus, but they present certain structural peculiarities, some in the prominence of the mandibles and all in the development of the apical spines of the tibiæ. In the first of the species described below these characters are notable enough to suggest the idea of generic distinctness, but in the succeeding species they so gradually become less marked successively that I think I may venture to include them all in *Helodes* without much fear of misleading. It is possible that some of the small species have the labial palpi of *Cyphon*. Unfortunately most of the examples before me have their heads tucked in so that the labial palpi cannot be seen, and there are only one or two of which I can spare a specimen to be broken. *H. Olliffi* has certainly the labial palpi of a true *Helodes*. In *H. cinctus*, though I cannot be quite certain, the apical joint appears to be at right angles with the penultimate and to be inserted close to the apex of the latter. In the species which I have called "Cyphon?" there is a distinct apical spine to the tibiæ, though in some it is very small and needs to be looked for.

Helodes princeps, sp.nov.

Sat late oblongus; sat convexus; nitidus; supra glaber, subtus dense breviter pubescens; supra niger, corpore subtus ore antennis pedibus capite postice prothoracisque marginibus rufescentibus; capite prothoraceque subtilius vix crebre punctulatis; hoc quam longiori plus quam duplo latiori, angulis posticis rectis; elytris nullo modo carinatis, sparsim inæqualiter punctulatis, puncturis magnitudine diversis; antennis quam corporis dimidium vix brevioribus, articulis 2° 3° que conjunctis quam 4^us brevioribus.

[Long. 4, lat. $2\frac{1}{5}$ lines.

This remarkable insect has entirely the general appearance of a very large robust *Helodes*. Its mandibles, however, are scarcely

less developed than those of *Dascillus* and the apical spines of its tibiæ (though not large) are quite well-defined. The apical joint of its maxillary palpi is shorter and considerably less stout than the preceding joint. It departs from *Helodes* also in its glabrous upper surface; I do not think the example before me is abraded The small diamond-shaped piece behind the middle of the metasternum and between the bases of the hind coxæ (which is noticeable in most if not all of the *Dascillidæ*, and which I take to be the scutum of the metathorax) is extremely conspicuous in this species.

Victoria; Alpine district.

HELODES CINCTUS, sp.nov.

Sat late oblongus; sat convexus; sat nitidus; crebre breviter fulvo-sericeo-pubescens, rufus, prothorace postice et elytrorum singulorum disco toto infuscatis; capite prothoraceque crebre subtiliter punctulatis, hoc quam longiori plus quam duplo latiori, angulis posticis subrectis; elytris leviter distincte 3-costatis, sat fortiter sat crebre punctulatis, antennis quam corporis dimidium manifeste brevioribus, articulis 2° 3° que conjunctis quam 4^{us} brevioribus. [Long. 3, lat. 1½ lines

Structurally very similar to the preceding but with the apical spines of the tibiæ less developed though quite distinct. In the example before me the infuscation of each elytron leaves only all the margins narrowly red. The puncturation of the elytra is about as strong but not nearly so close as in the European *H. minutus*, Linn.; it becomes finer and feebler towards the apex, there are no transverse wrinkles

Victoria; Alpine district.

HELODES OLLIFFI, sp.nov.

Oblongus; sat parallelus; depressus; pubescens; obscure fuscus, antennarum basi tibiis tarsisque paullo dilutioribus; capite subtiliter, prothorace subtilissime, crebre punctulatis, hoc fere semicirculari basi bisinuato; elytris crebre minus subtiliter punctulatis, lineis 3 elevatis obsoletis instructis,

antennis maris corporis dimidio longitudine æquali, feminæ paullo brevioribus, articulo 2° parvo, 3° quam 4^{us} haud breviori.

Maris segmento ventrali penultimo profunde rotundatim emarginato, incisura dense hirta; segmento apicali late longitudinaliter concavo. [Long. 3, lat. $1\frac{2}{5}$ lines (vix).

Not unlike the European *H. minutus*, L., in build, but of much darker colour, evidently more depressed, and of more fragile appearance; the prothorax is of similar shape but very much more finely punctured; the puncturation of the elytra also is finer. The structural characters seem to be quite as in *H. cinctus* (apart from the slight difference in the labial palpi alluded to above), than which the present species is narrower and more finely punctured.

S. Australia and Victoria.

HELODES MONTIVAGANS, sp.nov.

Oblongus; sat parallelus; depressus; pubescens; niger, capite (hoc postice infuscato) prothorace (hoc antice transversim infuscato) scutello antennarum basi pedibusque testaceis; capite crebre subtiliter punctulato; prothorace fere semicirculari basi bisinuato, fere lævi; elytris sat fortiter minus crebre punctulatis, lineis 3 elevatis vix notatis; antennarum articulis 2° 3°que conjunctis 4° subæqualibus.

[Long. $1\frac{4}{5}$, lat. $\frac{4}{5}$ line.

This species is (apart from its distinct colouring) notable for its almost lævigate prothorax in combination with strongly punctured elytra. I have not been able to examine the labial palpi, but I have little doubt they are like those of *H. Olliffi*, with which the present insect agrees in other structural characters. The elytra are much less closely punctured than those of the European *H. minutus*; their puncturation is not at all rugulose and is without transverse wrinkles.

Victoria; Alpine district.

HELODES (CYPHON ?) PICTUS, sp.nov.

Ovalis; sat convexus; pubescens; obscure rufus, capite postice prothoracis disco et elytrorum fasciis 2 apiceque nigris, antennis apicem versus corpore subtus femoribusque infuscatis; capite prothoraceque obscure minus crebre punctulatis; hoc perbrevi, valde transverso, angulis posticis obtusis; elytris minus subtiliter sat crebre punctulatis, puncturis apicem versus gradatim subtilioribus; antennarum articulis 2° 3°que conjunctis (hoc quam ille multo minore) 4° paullo brevioribus. [Long. $1\frac{2}{3}$, lat. $\frac{4}{5}$ line.

The colour of the elytra is quite a bright red; the black fasciæ are quite conspicuous though not very sharply defined; the anterior fascia is a little behind the base, which it reaches on the suture, the posterior is slightly behind the middle. The puncturation of the elytra is almost exactly as in *H. Olliffi;* there is no trace of costæ or elevated lines.

[redacted]

prothoraceque confertim subtiliter punctulatis; hoc brevi transverso, angulis posticis subrotundatis; elytris sat crebre sat subtiliter punctulatis; antennarum articulo 3° quam 4^{us} haud multo breviori, 2° quam ille parum breviori.

[Long. $1\frac{1}{2}$ (vix), lat. $\frac{7}{10}$ line.

In the example before me the suture, the region of the scutellum, and the apex are the infuscate parts of the elytra. This species resembles *H. pictus* in build, but is even more rounded at the sides and is much more finely punctulate than either of the last preceding two species. The elytra are punctured much like those of the European *Cyphon variabilis*, Thoms.

Victoria; also by sweeping on the banks of the Ovens.

HELODES (CYPHON ?) ADELAIDÆ, sp.nov.

Oblongus; modice convexus; pubescens; piceo-brunneus vel sordide testaceus, antennarum basi pedibusque dilutioribus; capite crebre, prothorace minus crebre, subtiliter punctulatis; hoc perbrevi valde transverso, angulis posticis obtusis; elytris crebre subtilius punctulatis; antennarum articulis 2° 3° que conjunctis (hoc quam ille multo minore) 4° vix brevioribus.

[Long. $1\frac{3}{5}$, lat. $\frac{7}{10}$ line.

The antennæ resemble those of *H. pictus*, from which species its more elongate build, uniform drab or piceous colouring, and finer puncturation will at once distinguish the present insect. The elytra are punctured about as strongly as, but a trifle less closely than, those of the European *Cyphon pallidulus*, Boh.

S. Australia; near Adelaide.

HELODES (CYPHON ?) SPILOTUS, sp.nov.

Subparallelus; sat convexus; pubescens; brunneo-testaceus, palpis antennisque (basi excepta) nigricantibus, elytris postice nigro-maculatis; capite prothoraceque crebre subtiliter punctulatis; hoc sat transverso minus brevi, angulis posticis rotundato-obtusis; elytris crebre sat fortiter subrugulose punctulatis; antennarum articulis 2° 3° que conjunctis (hoc quam illo minore) 4° longitudine æqualibus.

[Long. $1\frac{3}{5}$, lat. $\frac{3}{5}$ line.

A more cylindric species than any of the preceding, distinguished also by the rough puncturation of its elytra, which also are transversely wrinkled. In the example before me there are four very conspicuous black splashes on the hinder half of each elytron. Compared with the elytra of the European *Cyphon pallidulus*, Boh., those of the present species are distinctly more closely and roughly punctured.

S. Australia; near Port Lincoln.

HELODES (CYPHON ?) LINDENSIS, sp.nov.

Ovalis; minus convexus; pubescens; nigro-piceus, supra ferrugineus vel brunneo-testaceus (elytrorum fascia mediana infuscata excepta), antennis (his apicem versus infuscatis) pedibusque testaceis; capite prothoraceque subtiliter sat crebre punctulatis; hoc brevi fortiter transverso angulis posticis subrectis; elytris subtiliter minus crebre punctulatis; antennarum articulis 2° 3° que (hoc quam ille graciliori vix [redacted]

The little insect for which I propose this name cannot I think be referred to any previously described genus. It has very much the facies of *Cyphon*, but differs by its much harder teguments and the structure of its sterna. In both these characters it seems to agree with the South American genus *Artematopus*, but in that the antennæ are said to be very long and the tarsi lamellated, the basal joint of the latter being "as long as the three following."

I have little doubt but that the example before me is a male. The dilatation of the intermediate joints of the antennæ is certainly suggestive of that sex as also is the structure of the hind body, the antepenultimate ventral segment bearing a strong carina down its middle. The apical ventral segment is somewhat evenly rounded behind. From the apical orifice of the hind body two longish filaments protrude. The piece of the undersurface which I have referred to above (vide *Helodes princeps*) as being probably the scutum of the metathorax is extremely wide in the present species, being fully as wide as a quarter of the whole distance across the undersurface.

I am sorry that, having only a single example, I have been unable to examine any but the external characters of this insect.

SCLEROCYPHON MACULATUS, sp.nov.

Brunneo-testaceus, nigro-maculatus; pubescens; creberrime subtilissime punctulatus; elytris obsolete striatis, obscure transversim rugatis. [Long. $1\frac{4}{5}$, lat. $1\frac{1}{10}$ lines.

On the head the dark markings consist of some vague shading and also two spots on the vertex; on the prothorax of some ill-defined spots on the disc not extending to the middle or the vicinity of the lateral margin, on the elytra of a number of blotches; on the underside these occupy nearly the whole surface except the hind body, on which, however, there are some dark spots, the femora are nearly black, the base of the tibiæ being also marked with dark colouring. The apical spine of the tibiæ is extremely feeble, on the anterior four legs nearly wanting. The dilated joints of the antennæ are darker in colour than the rest.

Victoria; Alpine district.

[redacted]

METRIORHYNCHUS MONTICOLA, sp.nov.

Ater, prothoracis lateribus elytrisque rufis, his antice prope suturam longitudinaliter late nigro-vittatis; prothorace leviter transverso, 7-areolato; elytrorum sutura margine laterali lineisque 4 discoidalibus costatis, intervallis biseriatim sat crasse cancellato-punctulatis, rostro brevi.

[Long. $4\frac{4}{5}$, lat. $1\frac{3}{8}$ lines.

I have seen only a female example of this species; its antennæ are like those of *M. lugubris*, Waterh., as figured Tr. Ent. Soc., Lond., 1877, Pl. II., fig. 70. The rostrum is of the length of the basal joint of the antennæ. The intervals of the costæ on the elytra are punctured exceptionally coarsely (decidedly more coarsely than in *M. erythropterus*, Er.) and here and there the series are confused by two of the punctures coalescing; there are no distinct lines separating one row of punctures from another in the several pairs except close to the base. The black vitta in the example before me commences on the base of each elytron [redacted]

The black elytral spot commences on the suture slightly in front of the middle and reaches back nearly to the apex; it is of oblong-oval shape and at its widest touches the 2nd elytral costa on either side. The rostrum equals in length about three-quarters the length of the prothorax. The antennæ are like those figured (Trans. Ent. Soc., 1887, Pl. I., fig. 2) by Mr. Waterhouse as pertaining to *M. rufipennis*, Fab., their branches being very evidently longer than in *M. erythropterus*, Er. The punctures in the intercostal series on the elytra are about as strong as in *M. erythropterus*, but are less transverse, and the two rows of each pair are separated from each other much as in that species. Probably this insect resembles *M. rufipennis*, Fab., but differs from it at any rate in its elytra being bi-colorous; also (if Dr. Erichson identified *M. rufipennis* correctly) in its prothorax being much less elongate.

W. Australia; Eyre's Sandy Patch; taken by Mr. Graham.

METRIORHYNCHUS LÆTUS, sp.nov.

Ater, prothoracis lateribus et elytrorum singulorum marginibus omnibus (basali prope scutellum excepto) aurantiacis, horum costis hic illic aurantiaco-tinctis; prothorace vix transverso, 7-areolato; elytrorum sutura margine laterali lineisque 4 discoidalibus costatis, intervallis antice obscure biseriatim postice confuse cancellato-punctulatis.

Maris (exempli typici) rostro brevi, antennis sat fortiter (fere ut *M. erythropteri* maris, Er.) pectinatis.

Feminæ (exempli typici) rostro multo minus brevi, antennis fere ut *M. erythropteri* feminæ.

The orange border of the elytra is at its widest at the apex (where it is wider in the female example before me than in the male) and is markedly wider at the lateral margins than at the suture; in the male before me the elytral costæ are scarcely splashed with orange colour, in the female very distinctly; probably these colour characters are variable. The rostrum in the male is scarcely longer than the 3rd joint of the antennæ, in the female it is nearly as long as the 3rd and 4th joints together.

The punctures in the intercostal series on the elytra are fairly well defined and are of the usual form (*i.e.*, somewhat quadrate enclosures bounded by fine carinæ) but they are distinctly biseriate in arrangement only at the extreme base where the two rows of each pair are separated from each other by a distinct elevated line. The costa next the suture is feebler than the others except near the base. Near *M. marginatus*, Er., but differing in prothorax being red at the sides, and (if I have correctly identified *M. marginatus*) by the much longer branches of the antennæ in the male, the intercostal sculpture of elytra not distinctly biseriate, elytral suture orange-coloured, &c.

N. S. Wales; taken by Mr. Sloane near Bulli.

CALOCHROMUS.

In a monograph of this genus by Mr. C. O. Waterhouse (Cist. Ent. ii., pp. 195, &c.) the main division of the genus is founded on the structure of the maxillary palpi, but I find this to be sexual,

TELEPHORUS GALEATUS, sp.nov.

Niger, mandibulis antennarum basi prothorace femoribus tibiisque (anticis totis, ceteris ex parte) testaceis; capite prothoraceque sparsim obscure punctulatis; hoc quam longiori fere duplo latiori, antice posticeque latitudine æquali, lateribus leviter arcuatis; elytris crebre minus fortiter punctulatis; antennis robustis.

Maris antennis quam corporis dimidium sat longioribus, articuli 10[i] apice externa antrorsum producto, articulo apicali difformi intus retrorsum dentiformi; segmento ventrali sexto apice profunde arcuatim emarginato.

Feminæ antennis quam corporis dimidium brevioribus, articulis simplicibus; segmento ventrali sexto haud emarginato.

[Long. $2\frac{2}{5}$, lat. 1 line (vix).

Very much like the preceding in general appearance, but differing *inter alia* by its shorter antennæ (with remarkable sexual characters in the apical joints of the male), much more transverse prothorax and less strongly punctured elytra. The apical joint of the antennæ in the male is produced backward in a kind of tooth or lobe at its inner hind corner (corresponding to a somewhat similar forward projection at the outer front corner of the 10th joint) and is constricted a little before the apex, the part beyond the constriction being somewhat globular. The shape of the apical joint from a certain point of view bears a rough resemblance to that of a helmet.

Victoria; on flowers in the Alpine district.

TELEPHORUS FUSICORNIS, sp.nov.

Niger, capite antennarum basi prothorace femoribus anticis et tibiarum anticarum (late) intermediarumque (anguste) basi rufotestaceis; capite prothoraceque lævibus; hoc quam longiori minus quam duplo (antice quam postice manifeste) latiori, lateribus leviter arcuatis; elytris fortiter sat crebre punctulatis; antennis robustis.

Maris antennis quam corporis dimidium vix longioribus, articulo 9° valde dilatato et elongato, segmento 6° apice profunde arcuatim emarginato.

Femina latet. [Long. 2, lat. $\frac{4}{5}$ line.

Very like *T. Victoriensis*, but with the head and base of antennæ testaceous-red, and the sexual characters of the antennæ quite different.

Victoria: Upper Yarra River; sent by C. French, Esq.

TELEPHORUS NOBILITATUS, Er.

The acquisition (through the courtesy of Mr. J. J. Walker, R.N.) of a specimen taken in Tasmania evidently pertaining to this insect enables me to say that *T. vibex*, Blackb., is very near to it, but differs from it considerably in colouring, the elytra being violet (not blue-green), the mesosternum entirely, and the metasternum for the most part, being yellow (not black); and the stigmata of the hind body not being black. In *T. vibex*, moreover, the elytra are much less punctured anteriorly than in *T. nobilitatus*, and the part next the suture on either side in its front portion is strongly convex longitudinally, this convex portion being limited externally by a deep longitudinal sulcus. I have seen specimens of *T. nobilitatus* also from S. Australia and Victoria, and a specimen in my collection, said to be from Queensland, scarcely differs except in the testaceous colour of the base of the femora. The males of *T. nobilitatus* have the hind tibiæ arched somewhat strongly.

SILIS AUSTRALIS, sp.nov.

Angusta, sat parallela; breviter pubescens; minus nitida; obscure cyanea, capite antice prothoraceque testaceis, tibiarum anticarum et antennarum articulorum basalium basi rufescenti; capite antice sat producto, crebre fortius punctulato; prothorace cordato, quam latiori vix longiori, ut caput punctulato, lateribus subtus appendiculatis; elytris fere ut prothorax, sed paullo magis crebre, punctulatis; antennis quam corporis partes duæ vix longioribus. [Long 3, lat. $\frac{4}{5}$ line.

[redacted]

The downward-directed appendage of the sides of the prothorax is no doubt characteristic of the male. This insect seems to be a genuine *Silis*, the only abnormal character I notice consisting in the head being somewhat strongly and narrowly produced in front of the antennæ.

S. Australia.

LAIUS FEMORALIS, sp.nov.

Niger, prothorace elytrorum fascia lata mediana (hac ad suturam et ad margines laterales dilatata) abdomineque (hujus segmento apicali et segmentorum ceterum maculis lateralibus exceptis) rufo-testaceis; pilis erectis elongatis vestitus; capite prothoraceque vix perspicue punctulatis; hoc quam longiori dimidio latiori, latitudine majori ante medium posita, lateribus valde rotundatis; elytris in parte rufotestacea crebre fortiter rugulose, in parte nigra antica sat fortiter sat rugolose, in parte nigra postica parum perspicue, punctulatis.

Maris antennarum articulo 1° brunneo-testaceo apice extus fortiter dilatato, 2° supra brunneo-testaceo quadratim valde dilatato supra concavo subtus convexo, femoribus anticis supra in medio valde triangulariter excisis.

[Long. 2, lat. $\frac{4}{5}$ line.

The width of the elytral fascia on the suture and on the lateral margins is not much less than half the length of the elytra; between the suture and lateral margin on either side the fascia is strongly and arcuately emarginate both in front and behind.

This species is near *L. (Apalochrus) cinctus*, Redtb., but with the dark part of the elytra scarcely cyaneous. It differs from *L. cinctus* (if I have identified it correctly) also by the shape of the prothorax, which is at its widest very near the front and from that point is narrowed arcuately but very strongly hindward. I have not seen a male of the species that I take to be *L. cinctus.*

S. Australia.

LAIUS EYRENSIS, sp.nov.

Setis erectis vestitus; subtus piceus, capite nigro, prothorace elytrisque testaceo-rufis, his fascia lata basali et macula

magna subapicali cyaneis, antennis piceis basi rufis, pedibus testaceo-brunneis; capite prothoraceque obscure punctulatis; hoc minus transverso, ante basin profunde transversim sulcato, lateribus in medio subangulatis post medium sinuatis prope basin parallelis, angulis posticis rectis, elytris antice crebre fortiter rugulose postice sparsius minus fortiter, punctulatis.

Maris antennarum articulo 2° ad apicem externum in processu elongato recurvo producto; abdominis apice dorsali valde bifido.

Feminæ antennis segmentoque dorsali apicali simplicibus.

[Long. $1\frac{2}{5}$, lat. $\frac{1}{5}$ line.

Probably near *L. rufovirens*, Fairm., but differing in the shape of the prothorax, the ventral segments not red, &c., &c.: also probably in sexual characters (which M. Fairmaire does not refer to).

S. Australia; basin of Lake Eyre.

Laius pretiosus, sp.nov.

Subopacus; haud setosus; subtus obscurus, capite nigro, prothorace elytrisque rufis, illo medio infuscato his singulis vitta lata irregulari cyanea ornatis, antennis pedibusque testaceis, femoribus posticis infuscatis; capite crebre, prothorace sparsius, distincte punctulatis; hoc fortiter transverso, lateribus rotundatis postice subexplanatis; elytris subcoriaceis minus distincte punctulatis.

Mas latet. [Long. $1\frac{1}{3}$, lat. $\frac{1}{4}$ line.

The cyaneous vittæ occupy the greater part of the surface of the elytra and meet at the extreme base and also near the apex. If they be regarded as forming the ground colour, there then appears a large common diamond-shaped red spot on and around the suture, extending from a little behind the suture to the middle, a triangular red spot on each side with its base on the lateral margin and an apical red spot.

I have not seen a male of this species, but it is so perfectly distinct from all previously described of the genus that I have no hesitation in describing it.

S. Australia; basin of Lake Eyre.

TENEBRIONIDÆ.

BLEPEGENES NITIDUS, sp.nov.

Obscure æneus, sat nitidus, pedibus nigro-piceis (tibiis apice tarsisque rufescentibus exceptis), antennis basi piceis apicem versus rufescentibus; vix manifeste punctulatus; capite haud spinoso, fronte retrorsum in spatio depresso postice bifido leviter elevata; collo et mesothoracis scuto granulatis; prothorace antice in medio sat anguste emarginato, lateribus in medio sat fortiter (et postice minus fortiter) rotundato-dilatato; elytris fortiter striatis, interstitiis omnibus manifeste (alternis magis fortiter) costatis, costis ante apicem obsoletis. [Long. $9\frac{1}{2}$, lat. $3\frac{3}{5}$ lines.

Differs from *B. aruspex*, Pasc., in the head not spinose, in the forehead being gradually and widely elevated hindward into a kind of flattened tubercle, in the prothorax being emarginate in the middle of its front margin and having merely rounded dilatations in the places where that of *aruspex* is spined, and in the elytra having all the interstices of the striæ nitid and costiform,—the alternate interstices being not much more costate than the rest. *B. equestris*, Pasc., is a larger insect with the elytral interstices costate only at the sides.

Queensland; in the collection of C. French, Esq.

DÆDROSIS VICTORIÆ, sp.nov.

Angusta; convexa; nitida; atra, vix æneo-micans, antennis palpis pedibusque rufis; capite in figura pentagonali depresso, crasse subcrebre vix rugulose punctulato; prothorace quam longiori vix (antice quam postice paullo) latiori, antice truncato haud canaliculato, fortiter sat crebre punctulato, in medio anguste longitudinaliter lævi, lateribus modice arcuatis

vix crenulatis latitudine majori ante medium posita, basi late leviter triangulariter concavo, angulis posticis obtusis; mesothoracis scuto crebre sat fortiter punctulato, scutello lævi; elytris antrorsum in medio fortiter productis, modice punctulato-striatis, interstitiis fere planatis fere ut striæ punctulatis; antennis prothoracis basin attingentibus, apicem versus sat fortiter incrassatis.

♂. Abdomine antice longitudinaliter concavo, parte concava leviter strigosa. [Long. 4, lat. $1\frac{1}{4}$ lines.

Distinguished from its described allies *inter alia* by its testaceous-red antennæ and legs.

Victoria: in the Alpine district.

ADELIUM PUSTULOSUM, sp.nov.

Minus nitidum; supra fusco cupreum vel obscure viride, corpore subtus pedibus antennisque nigro-viridibus, his extrorsum tarsisque vix picescentibus; capite inæquali sat fortiter punctulato; prothorace quam longiori fere duplo (postice quam antice haud multo) latiori, ruguloso, sat fortiter vix crebre punctulato, antice emarginato, postice truncato, lateribus fortiter rotundatis sat explanatis mox ante basin rectis, angulis posticis acute rectis; elytris postice acuminatis vix striatis seriatim subtilius punctulatis, interstitiis fere planis pustulis numerosis nitidis seriatim instructis, basi humerisque sat æqualiter rotundatis, lateribus leviter arcuatis; antennis sat elongatis, articulo 3° sequentibus 2 conjunctis longitudine æquali. [Long. $7\frac{1}{3}$–6, lat. $2\frac{2}{3}$–$2\frac{1}{4}$ lines.

Owing to the presence of a depression on either side of the middle of the prothorax close to the base, the base viewed obliquely from in front appears bisinuate, though in reality it is exactly truncated. The row of conspicuous shining pustules or small round tubercles running down each elytral interstice forms a very distinctive character; these pustules in some examples are almost obsolete in the front part of the interstices near the suture

The lateral outline of the prothorax in this species is almost exactly as in *A. similatum*, Germ., but is a little more dilate-rotundate in the middle ; the sculpture of the same segment is of the same kind as in *A. similatum* but less coarse ; the front is considerably more strongly and evenly emarginate. The antennæ are long and slender as in *A. similatum*, but with the 3rd joint a little less elongate.

Victoria ; on the higher mountains.

N.B.—I have seen a few specimens from Victoria of an insect which I take to be that M. Blessig (Hor. Soc. Ent. Ross. I. p. 100) called *A. similatum*, Germ. This Victorian species is extremely close to *similatum* (of which I have never seen a Victorian example really agreeing with the S. Australian type), but differs in several respects, *e.g.*, the prothorax wider behind, considerably more strongly explanate laterally and altogether larger in proportion to the elytra ; it is possibly only a local form of *A. similatum*.

Adelium victoriæ, sp.nov.

Ut *A. pustulosum* coloratum ; capite æquali sparsius minus fortiter punctulato ; prothorace quam longiori plus quam dimidio (postice quam antice haud multo) latiori, vix ruguloso, subtilius parum crebre punctulato, antice emarginato, postice truncato, lateribus sat fortiter rotundatis haud explanatis, ante basin vix sinuatis, angulis posticis late obtusis ; elytris fere ut *A. pustulosi* sed basi in medio antrorsum rotundato-producta ; cetera ut *A. pustulosi*. [Long. $5\frac{1}{2}$, lat. $2\frac{2}{3}$ lines.

Extremely like *A. pustulosum*, but I cannot regard the differences as non-specific. The hind angles of the prothorax extremely obtuse (though not rounded), the sides of the prothorax scarcely sinuate before the hind angles and the front of the elytra strongly pushed forward in the middle form a strong combination of characters. There is a similar elytral formation in the very plentiful species which I take to be *A. neophyta*, Pasc., but in the present insect it is still more marked.

Victoria ; in the collection of C. French, Esq.

Adelium inconspicuum, sp. nov

Nitidum; æneum, antennis (basi excepta) tarsisque piceo ferrugineis; capite subplanato sat fortiter vix crebre punctulato; prothorace quam longiori partibus 3 (postice quam antice vix) latiori, leviter minus subtiliter minus crebre punctulato, antice emarginato, postice truncato, haud canaliculato, lateribus sat æqualiter rotundatis haud explanatis, angulis posticis obtusis; elytris ovalibus punctulato-striatis, interstitiis leviter sat crebre parum subtiliter punctulatis, epipleuris subfortiter punctulatis, basi in medio antrorsum manifeste rotundato-producta; antennis sat brevibus, apicem versus leviter incrassatis, articulo 3° sequentibus 2 conjunctis vix æquali.

[Long. $3\frac{4}{5}$-$4\frac{1}{5}$, lat. $1\frac{3}{5}$-$1\frac{4}{5}$ lines.

Very near the common species which I believe to be *A. neophyta*, Pasc., (and which must be a close ally of *A. brevicorne*, Bessig), but smaller, with puncturation much less fine throughout (though not deep), sides of prothorax more rounded, epipleuræ of elytra very conspicuously punctulate. *A. brevicorne* is *inter alia* described as very much more finely punctulate than the present insect and is larger.

Kangaroo Island; taken by Mr. J. G. O. Tepper.

Adelium alpicola (? A. calosomoides, Kirby, var.)

Robustum; nitidum, minus (♂) vel valde (♀) convexum, supra æneum vel viride vel viridi nigrum vel aureo-viride, antennis (basi excepta) tarsisque rufis; capite inæquali sat fortiter minus crebre punctulato; prothorace quam longiori fere duplo (postice quam antice quarta parte) latiori, leviter canaliculato, paullo inæquali ut caput punctulato, antice arcuatim emarginato, postice truncato, lateribus fortiter æqualiter rotundatis late explanatis, angulis posticis obtusis; elytris postice acuminatis, sat fortiter punctulato-striatis, interstitiis plus minus convexis sparsim subtiliter punctulatis alternis (præsertim 5) apicem versus subcarinatis, humeris rotundatim

[redacted]

fere subprominulis, basi media vix antrorsum producto, lateribus (præsertim feminæ) arcuatis; antennis filiformibus modice elongatis, articulo 3° sequentibus 2 conjunctis longitudine æquali. [Long. 7½–8, lat. 3–3$\frac{4}{5}$ lines.

I do not feel sure that this large and handsome insect may not be an extreme Alpine var. of *A. calosomoides*, Kirby. According to the description that species is much smaller (long. 6 lines) and the antennæ and tarsi are not rufous; in other respects it agrees fairly with the somewhat meagre description. I do not think it is a var. of the species which I have previously considered to be *A. calosomoides*, but it is possible I may have been mistaken in my identification, and I do not think any insect could be confidently identified with Kirby's description unless the original type could be referred to. The remarkable variability in colour and in the degree of convexity of the elytral interstices is in keeping with what is frequently observed in species occurring on high mountains.

Victoria; under *Eucalyptus* bark at high elevations on the Alps.

ADELIUM TROPICUM, sp.nov.

Robustum; sat nitidum; sat convexum; cæruleo-nigrum; capite prothoraceque (fere ut *A. auguralis*, Pasc.), crebre fortiter vermiculato-rugulosis; hoc quam longiori plus quam dimidio (postice quam antice circiter 5^a parte) latiori, canaliculato, antice emarginato postice truncato, lateribus sat rotundatis crenulatis modice explanatis mox ante basin parallelis, angulis posticis rectis nullo modo extrorsum prominentibus, elytris ovalibus fortiter costatis, costis prope apicem in tuberculis fractis, costarum interstitiis transversim subtuberculatim seriatim interruptis; antennis sat crassis minus elongatis, articulo 3° quam 4^{us} 5^{us}que conjuncti multo longioribus.

[Long. 8, lat. 3$\frac{3}{5}$ lines.

Allied to *A. porcatum*, Fab., and *A. augurale*, Pasc., but differing from both *inter alia* by the elytra being entirely impunctate, the only approach to puncturation consisting of the quasi impressions on the elytra which are formed in the intervals between the

costæ by those intervals being blocked here and there at irregular intervals by lateral extensions of the costæ, the lateral extensions in some aspects having a more or less tuberculiform appearance; near the apex the costæ themselves become broken into tubercles.

N. Territory of S. Australia.

Adelium lindense, sp.nov.

Sat nitidum; leviter (♂) fortiter (♀) convexum; aureo-æneum vel nigro-cyaneum; subtus obscurius, pedibus antennisque concoloribus, capite minus crebre punctulato foveis nonnullis profundis impresso; prothorace quam longiori partibus tribus (postice quam antice haud multo) latiori, leviter minus crebre punctulato et foveis nonnullis profundis sat magnis impresso, antice emarginato postice leviter bisinuato, lateribus valde rotundatis fortiter explanatis, marginibus validis crassis, angulis posticis obtusis retrorsum manifeste productis; elytris sat parallelis (♂) late ovalibus (♀), haud striatis, foveis sat magnis sat rotundis seriatim irregulariter instructis, his puncturis multo minoribus longitudinaliter conjunctis, interstitiis alternis postice subcarinatis, epipleuris obsolete vix perspicue punctulatis; antennis filiformibus modice elongatis articulo 3° quam 4^{us} 5^{us}que conjuncti vix longiori.

[Long. $7\frac{1}{2}$-$8\frac{1}{2}$, lat. 3-$3\frac{3}{5}$ lines.

A large handsome species resembling *A. auratum*, Pasc., but differing from it *inter alia* in the less emarginate base of the prothorax, and in the elytral sculpture,—consisting of rows of unevenly placed *round* foveæ which are connected one with another longitudinally by series of much finer punctures. The strongly thickened lateral edges of the prothorax distinguish the present insect from most of its congeners.

S.A.; Port Lincoln district.

Adelium angulatum, sp.nov.

Sat nitidum; modice (♂?) convexum, nigro-æneum; subtus nigrum, antennis pedibusque concoloribus; capite sat æquali leviter sparsius punctulato; prothorace quam longiori paullo

plus quam dimidio (postice quam antice tertia parte) latiori sparsim obsolete punctulato et foveis paucis impresso, antice sat fortiter (postice leviter) emarginato, hexagonali, lateribus minus late explanatis mox ante basin sinuatis, marginibus validis crassis, angulis posticis subrectis ; elytris fere ut *A. Lindensis* sed interstitiis alternis postice vix subcarinatis ; antennis ut *A. Lindensis*. [Long. $6\frac{1}{2}$, lat. $2\frac{4}{5}$ lines.

Remarkably like the preceding in respect of its elytral sculpture, but *inter alia* differing from it (and from all other *Adelia* known to me) by the singular shape of its prothorax, each side of which is formed by two nearly straight lines meeting in a scarcely rounded angle at a point scarcely behind the middle. The prothorax is much less transverse than in *A. Lindense*, much less explanate laterally, and more narrowed in front. This species also bears a certain resemblance to *A. cisteloides*, Er., from which it is at once separated *inter alia* by the strongly thickened lateral margins of its prothorax. As in *A. Lindense* the seriate foveæ on the elytra are much larger in some examples than in others.

S.A.; Port Lincoln district.

ADELIUM ÆQUALE, sp.nov.

Sat nitidum ; sat convexum ; totum nigrum ; capite subruguloso antice sparsim subtiliter (postice magis fortiter) punctulato ; prothorace quam longiori fere partibus tribus (postice quam antice minime) latiori, leviter sat crebre punctulato et puncturis magnis paucis (circiter 6) instructo, antice bisinuato, postice leviter late emarginato, lateribus sat rotundatis modice explanatis, marginibus sat subtilibus, angulis posticis obtusis ; elytris ovalibus haud striatis, seriatim punctulatis, puncturis in seriebus magnitudine variis latera apicemque versus fere obsoletis, interstitiis perspicue sat crebre punctulatis ; antennis sat filiformibus, articulo 3° quam 4^{us} 5^{us} que conjuncti vix longiori. [Long. $6\frac{1}{5}$, lat. $2\frac{4}{5}$ lines.

Resembles the preceding two species, *A. cisteloides*, Er., and some others, in having the longitudinal puncturation of the elytra unequal. In the unique example before me the rows consist of deep

but fine,—almost "needle point,"—punctures among which are interspersed a few much larger,—but even these are (not foveæ but) merely strong punctures; from analogy, however, it is likely that in other examples the whole system of puncturation might be somewhat coarser. In all examples examined of the two preceding and of *cisteloides*, however, the sculpture of the elytra is infinitely coarser; moreover in the present insect the elytral sculpture becomes very much enfeebled towards the sides and apex; the interstices also are very conspicuously punctured here, while in the preceding two (and also in *cisteloides*) they are lævigate or nearly so. The lateral edge of the prothorax is very much less thickened than in *angulatum* and *Lindense*, that segment is much more transverse than in *angulatum* and *cisteloides* and much less explanate and strongly rounded at the sides than in *Lindense*. The strongly produced middle part of the front margin of the prothorax (making the margin strongly bisinuate) is also a very distinctive character, and the absolutely flat elytral interstices [redacted]

[redacted]

vix sexta parte) latiori, leviter subtiliter sat crebre punctulato et puncturis nonnullis magnis instructo, antice et postice parum emarginato, lateribus minus arcuatis angustissime explanatis haud crenulatis, angulis posticis sat rectis; elytris vix striatis, seriatim sat fortiter punctulatis, puncturis sat rotundis, interstitiis lævibus antice planis, alternis postice costas interruptas formantibus.

♂ abdominis segmentis basalibus in medio planatis, longitudinaliter confertim strigosis. [Long. 6, lat. $2\frac{1}{5}$ lines.

A very distinct species on account of its black colour and the elongate elevations on the alternate elytral interstices being confined to the apical portion. It has much the appearance of a large *Chalcolampra*. Compared with *S. parallela*, Germ., the prothorax is considerably narrower in proportion to the elytra. Owing to the fineness of the general puncturation of the prothorax the larger punctures scattered over it are extremely conspicuous.

S.A.; Murray Bridge.

SEIROTRANA MONTICOLA, sp.nov.

Minus angusta; minus parallela; modice convexa; minus nitida; cupreo-ænea; capite prothoraceque crebre sat fortiter sat rugulose punctulatis puncturis majoribus nonnullis intermixtis; hoc quam longiori fere dimidio (postice quam antice quinta parte) latiori, antice leviter (postice late triangulariter) emarginato, lateribus modice rotundatis ante basin sinuatis leviter crenulatis nullo modo explanatis, angulis posticis sat acute rectis; elytris punctulato-striatis, puncturis in striis quadratis, interstitiis alternis convexis hic illic subinterruptis.

♂ abdominis segmentis basalibus in medio planatis, longitudinaliter fortiter minus crebre strigosis; segmento ultimo longitudinaliter valde carinato. [Long. $5\frac{3}{4}$, lat. $2\frac{1}{2}$ lines.

A very distinct species with extremely strong sexual characters, Much wider and less parallel than the preceding, and at once distinguished by the alternate elytral interstices being moderately convex throughout and scarcely interrupted, the quasi-interruptions being little more than feeble depressions in the costæ.

Victoria; a single example near the summit of Baldi.

SEIROTRANA DISPAR, sp.nov.

Minus elongata; minus parallela; sat convexa; sat nitida; cupreo-ænea; capite inæquali triangulariter planato crebre subfortiter punctulato; prothorace quam longiori dimidio latiori (postice quam antice fere quarta parte) latiori, crebre subtilius punctulato et puncturis sat magnis nonnullis intermixtis, antice leviter (postice late triangulariter) emarginato, lateribus modice rotundatis ante basin parallelis obsolete crenulatis haud explanatis, angulis posticis rectis; elytris nullo modo striatis, subtiliter seriatim punctulatis, interstitiis alternis obsolete interrupto-costatis.

♂ latet. [Long. 5, lat. $2\frac{3}{5}$ lines.

The fine prothoracic puncturation has a slight appearance of running into longitudinal strigosity; as in *S. simplex* it is so fine that the larger punctures are extremely conspicuous. The alternate interstices of the elytra are of the same nature as in *S.* [redacted]

[redacted]

incrassatis, articulo apicali quam 9^{us} 10^{us} que conjuncti multo breviori; epipleuris fortiter punctulatis; tarsis subtus breviter (quam *Dinoriæ pictæ*, Pasc., multo magis breviter) pilosis; oculis transversis (fere ut *Adeliorum*).

[Long. $2\frac{4}{5}$-$3\frac{3}{5}$, lat. 1-$1\frac{2}{5}$ lines.

The genera described by Mr. Pascoe (Ann. N.H., 1869, p. 140) as allies of *Adelium* are very briefly characterised, and widely diverse forms might happen to present in combination the two or three characters mentioned. Among these, *Licinoma* is characterised as having slight differences from *Adelium* in the shape of the mentum, the width of the eye, the concavity of the front margin of the prothorax, and the clothing of the tarsi beneath. The present species presents these differences, and therefore I refer it to *Licinoma*.

In all the specimens that I have seen of this insect, two of the foveæ or large punctures on the prothorax are placed a little in front of the middle, one on either side of the middle line; the apical joint of the hind tarsi is about the same length as the basal joint. The general appearance is that of a small *Harpalus*. I do not find any sexual characters other than in the males being smaller, narrower, and more parallel than the females, with the anterior tarsi moderately dilated. The elytra are strongly drawn forward in the middle of the base, so that the front margin of each elytron is very oblique.

LONGICORNES.

MONOHAMMUS FRENCHI, sp.nov.

Fusco-picea, pube fusca et albida maculatim ornato; superficie tota creberrime subtiliter subaspere punctulata, et in prothorace elytrisque puncturis sat crassis (in his sat æqualiter minus sparsim nihilominus postice gradatim subtilius, in illo sparsissime acervatim positis) instructa; elytrorum apice singulatim subangulato. [Long. 11, lat. $4\frac{1}{5}$ lines.

The head is densely clothed with pubescence of whitish and buff colour, presenting a marbled appearance, and has a well marked

longitudinal impressed line. The prothorax is densely pubescent and rather strongly transverse, and has an obscure transverse furrow in front and two parallel and more strongly defined ones in front of the base; its lateral spines are large and strong; its surface is of a dark buff-colour and bears in two rows (transversely placed, one immediately in front of, the other immediately behind, the middle) 6 very conspicuous whitish spots; there is also a good deal of whitish pubescence around the spines. The whitish pubescence on the elytra forms small well defined blotches presenting in parts a reticulate appearance and recalling a little the elytral pubescence of *Penthea vermicularia*, Don. The prevailing colour of the pubescence on the under-side and the legs is whitish, among which large well defined patches of dark buff-coloured pubescence are everywhere distributed. The antennæ of the example before me are slightly longer than the body; the basal two joints are brown, more or less marked with whitish; the other joints are whitish, but become nearly black near the apex; there [redacted]

[redacted]

type of a new genus eventually. The two very large tubercles on the front part of the disc of its elytra and the curiously produced shoulders render it extremely distinct from the previously described Australian *Eumolpidæ*. The produced shoulders and general form give it a certain resemblance to some *Hemiptera* (*e.g. Æchalia*).

N.S. Wales; Richmond R. and Tweed R. districts; sent to me by A. S. Olliff, Esq.

PAROPSIS YILGARNENSIS, sp.nov.

Subquadrato-ovata; convexa; supra rubra; capite, palpis, antennis, corpore subtus, pedibusque, brunneo-testaceis; prothoracis lateribus profunde bis emarginatis, disco subtilius crebre punctulato puncturis minutis intermixtis, parte laterali variolosa; elytris fortiter sat crebre confuse punctulatis, postice crebre subverrucosis, puncturis suturam versus et latera versus fuscis vittas 2 latas vix perspicuas formantibus.

♂ tarsorum anteriorum 4 articulo basali sat dilatato, quam 3^{us} angustiori. [Long. 4, lat. 3$\frac{2}{5}$ lines.

This species belongs to the first group of *Paropsis*. It is not unlike *P. maculata*, Marsh., in size and build. The puncturation of the head and prothorax is almost as in *P. Waterhousei*, Baly. The prothorax is not very much more than twice as wide as long, its shape being almost exactly as in *P. maculata*. The elytra are shaped as in *P. maculata* and are punctured almost like those of *P. lutea*, Marsh., except that the punctures are considerably less crowded near the scutellum. There are no distinct raised spots on the elytra, and the elytral punctures are concolorous with the derm except in two broad stripes, one near the suture, the other near the lateral margin, in which the punctures are darker. The prosternum is of moderate width and simply sulcate down the middle; it is very similar to that of *P. marmorea*, Baly.

The close evenly distributed puncturation of the prothorax in combination with the strongly bisinuate sides of that segment will distinguish this species, I think, from all its allies.

W. Australia; Yilgarn.

PAROPSIS LATIPES, sp.nov.

Subrotunda (femina paullo minus lata); valde convexa; supra minus nitida, flavo-brunnea, capite postice (nonnullis exemplis) prothoracis macula parva utrinque sublaterali elytrorum sutura plus minusve manifeste vittis 2 utrinque submarginalibus (plurimis exemplis fere obsoletis) et tuberculis nonnullis (plurimis exemplis his vix infuscatis) nigris; capite prothoraceque crebre minus fortiter subrugulose punctulatis; hoc (latera versus multo magis crasse punctulato) quam longiori multo magis quam duplo latiori, margine antico profunde emarginato in medio leviter convexo, lateribus fortiter rotundatis (latitudine majori fere in medio posita), angulis anticis sat productis minus acutis, posticis nullis; scutello piceo subcarinato obscure punctulato; elytris creberrime sat fortiter subseriatim punctulatis, tuberculis nonnullis (his nonnullis exemplis piceis vel nigris) seriatim [redacted]

either side; in these examples the tubercles on the elytra are scarcely noticeable being concolorous with the derm; in other examples there is a blackish shading a little within the lateral and front margins of the prothorax and in some the tubercles on the elytra are more or less infuscate appearing then as forming more or less fragmentary parts of fairly distinct longitudinal rows.

This species is a good deal like what I regard as *P. sublimbata*, Chp., but is markedly less convex than that insect (which is among the most strongly convex of the genus) and has its prothorax evidently more closely and rugulosely punctured, its underside black instead of pale brown, the basal joint of the dilated male tarsi much wider, and the sexual characters of the apical ventral segment quite different.

Victoria; Alpine district; found at high elevations.

Paropsis regularis, sp.nov.

Ovalis; fortiter convexa; supra minus nitida; capite testaceo postice nigro, rugulose minus crasse punctulato; prothorace testaceo maculis 2 permagnis (nonnullis exemplis conjunctis et fere superficiem totam tegentibus) ornato, quam longiori fere triplo latiori, margine antico profunde emarginato in medio leviter convexo, lateribus fortiter rotundatis antice vix sinuatis, latitudine majori pone medium posita, angulis anticis acutis sat productis, posticis nullis, disco sat fortiter ruguloso et crebre fortius punctulato, lateribus variolosis; scutello fusco, carinato, vix punctulato; elytris fusco-brunneis, late testaceo-marginatis, fortiter sat regulariter seriatim-punctulatis, tuberculorum nigrorum seriebus integris 9 ornatis, callo humerali modico nigro nitido, angulo humerali fere rotundato; corpore subtus nigro nitido testaceo-notato sat crebre sat fortiter (metasterno medio lævi excepto) punctulato; prosterno in medio bicarinato sat lato, carinis antice conniventibus; pedibus palpisque rufo-testaceis; antennis piceis basi testaceis.

♂. Tarsorum anteriorum 4 articulo basali sat dilatato quam 3^{ius} manifeste angustiori; segmento ventrali apicali leviter bigibbo, apice minute emarginato. [Long. $4\frac{4}{5}$, lat. $3\frac{9}{10}$ lines.

The prothorax across the apex of its front angles is nearly $\frac{2}{3}$ as wide as at its widest part. Viewed from the side the curve of the outline is an even one, its highest point being at about the middle of its length, and the height of the insect is about $\frac{1}{2}$ of its length. The male and female do not differ much in shape, the female being, however, a trifle narrower. The apical ventral segment of the female is simply rounded at the apex and its surface is even. In some specimens the extreme apex and base of the hind body and the middle of the prosternum are testaceous; the sides of the prosternum are always widely testaceous.

This does not seem to be a variable species.

Victorian Alps; found at high elevations.

[redacted]

MONOLEPTA BENALLÆ, sp.nov.

Oblonga; nigra, capite postice prothoraceque testaceis, elytris læte cyaneis; antennarum articulo basali elongato, 3° quam 2^{us} vix longiori; elytris capite vix manifeste, prothorace (hoc æquali) leviter subcrebre, elytris crebre minus crasse vix squamose, punctulatis; subtus parce pubescens; epipleuris in parte postica obsoletis. [Long. $1\frac{3}{5}$, lat. $\frac{3}{5}$ line (vix).

Very like *M. modesta*, Blackb., but differing (apart from colour) in the finer and less squamose puncturation of the elytra (which are very similar to those of the European *Luperus flavipes*, Linn.) and in the very evidently longer basal joint of the antennæ. Also very near *M. croceicollis*, Germ., but differing by the 3rd joint of the antennæ less than half as long as the 4th. The posterior coxal cavities are closed behind, the "subbasal lobe" of Dr. Baly (vide Journ. Linn. Soc. xx.) being present,—and in non-distorted specimens joining the apices of the epimera. All the tibiæ are mucronated. This species is extremely like a *Luperus*; I suspect that if the *Galerucidæ* were re-classified in accordance with Dr. Baly's scheme it would scarcely be separated from *Luperus* as the prosternum of that genus certainly seems to have a small "subbasal lobe."

Victoria; taken by Mr. Helms near Benalla; also by me near Euroa.

MONOLEPTA FROGGATTI, sp.nov.

Oblonga; nigra, capite (vertice excepto) prothorace (disco obscure piceo excepto) pedibus (his, praesertim tarsis, plus minusve infuscatis) et elytrorum vitta lata (hac basin apicemque attingente) brunneo-testaceis, antennis basi obscure dilutioribus; harum articulo basali minus elongato, 3° quam 2^{us} manifeste longiori; elytris sat crebre leviter vix rugulose capite sparsissime subtilissime, prothorace (hoc transversim sulcato) leviter inæqualiter, punctulatis; corpore subtus parce pubescenti; epipleuris in parte postica obsoletis.

[Long. $1\frac{3}{5}$, lat. $\frac{3}{5}$ line.

A very distinct species, with puncturation very like that of the preceding. The anterior coxal cavities are closed; the 3rd joint of the antennæ is about half as long as the 4th; the apical spine of the tibiæ is very small; the basal joint of the hind tarsi is not much shorter than the apical three joints together.

Victoria; taken by Mr. Froggatt near Ballarat.

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ON A COLLECTION OF LAND AND FRESH WATER SHELLS, FROM QUEENSLAND

By C. Hedley, F.L.S., and C. T. Musson, F.L.S.

Through the kindness and liberality of Dr. J. C. Cox, F.L.S., one of the writers, Mr. Musson, was enabled to spend a few months during the year 1887 searching for mollusca in South Queensland. The visit chanced to be when a prolonged drought, followed by disastrous floods, had greatly reduced the invertebrate population. Many species are thus only represented in Mr. Musson's collection by dead shells. Others in the lapse of time have been lost or mislaid, among them a slug discovered twice at Miriam Vale, first under a log near the head station and then on a ridge near Colosseum Creek, and again under Mt. Mee, North Pine River. It is described in the collector's note-book as, " one inch long, dark in colour, with sole of foot light except the rim which was dark, sharply keeled, hard and leathery." We are disposed to conjecture that this animal was *Atopos australis*, Heyneman.

The route pursued was as follows:—From Gladstone, reached August 8th, as a centre various points in the Port Curtis district were investigated, and Miriam Vale, Warro, Rodds Bay, Boyne, Facing and Curtis Islands were visited in succession. Rockhampton was then made the base of operations, and part of September and October was spent in collecting over the Berseker Range (one of whose highest summits is Mt. Archer), Gracemere, Mt. Morgan, and Olsen's Caves; shells from a subfossil deposit in the latter will be quoted as (c) in the following list. A trip west was also made to Jericho, Alpha, and Bogantungan via Coomooboolaroo. Leaving Rockhampton on October 12th, an overland journey to Brisbane was commenced by way of Westwood, Calliungal on the

River Dee, Torsdale on Prospect Creek, and Prairie Station on Kroombit Creek. Crossing to the Burnett watershed Cania was reached, the Three Moon Creek, Cania Station and Dalgangal passed in succession, and the traveller arrived at Gayndah on November 10th. Thence a course was shaped via Banban on the Barambah River, Boobeyjan and Kilkivan to Gympie. Two localities in this neighbourhood were searched and will be quoted in the following list as (a) a scrub nine miles north, and (b) another scrub at Blackfellow's Creek, twenty-seven miles south of the town. In continuation of the journey the Mary River was followed from Kenilworth to its source, and the summit of the Blackall Range attained by way of Canondale. After passing Durundu and Caboolture a trip was made up the North Pine River, and the rich scrubs around Mt. Mee were examined. This tour was then concluded, and Brisbane reached on December 6th.

The conchological booty was as follows:—

[redacted]

[redacted]

Warro, Mt. Archer, Gracemere, Cania, Banban, Kilkivan, Gympie (a), and Kenilworth.

A variety darker in colour, and having spiral lines more distinctly marked than the type, was found at Miriam Vale, Bogantungan, Torsdale and Cania.

T. DELTA, Pfeiffer.

In scrubs, arboreal; scarce.

North Pine River.

CONULUS TURRICULATUS, Cox.

Fairly plentiful.

Miriam Vale and Cania.

CHAROPA OMICRON, Pfeiffer.

Under logs in damp places; not plentiful.

Miriam Vale, Warro, Cania, Gympie and North Pine River.

C. IULOIDEA, Forbes.

Scarce.

Warro, Gracemere and Olsen's Caves (c).

C. FUNEREA, Cox.

Cania, Kilkivan.

LIMAX LÆVIS, Müller.

Miriam Vale, Brisbane and Kilkivan.

RHYTIDA WALKERI, Gray.

Under logs and stones in scrubs; widely distributed but nowhere very abundant.

Miriam Vale, Warro, Curtis Island, Mt. Archer, Gracemere, Olsen's Caves, Calliungal, Torsdale, Cania, Banban, Gympie (a) and (b), Kenilworth, and North Pine River.

R. splendidula, Pfeiffer.

Under logs and stones in scrubs; widely distributed and fairly plentiful.

Miriam Vale, Mt. Archer, Olsen's Caves and (c), Cania, Banban, Gympie (a) and (b), Kenilworth and North Pine River.

var. strangeoides, Cox.

Olsen's Caves (c), Gympie (a), and Kenilworth.

Planispira mariæ, Cox.

Under logs; scarce.

Kenilworth, North Pine River.

P. cyclostomata, Leguillou.

Under stones and logs, usually in open country; widely distributed

Miriam Vale, Warro, Cania (large), Kilkivan, Durundu (dark straw colour), Gympie (a) (very large), and North Pine River (greenish-purple colour).

var. MINOR, Mousson.

Mt. Archer.

CHLORITIS PORTERI, Cox.

Under logs; plentiful in places.

Gympie (a) and (b), Kenilworth, Durundu and Caboolture.

C. MANSUETA, Pfeiffer.

Not plentiful.

Gympie (a) and (b), and North Pine River.

C. ARIDORUM, Cox.

Under logs and stones; found in the dry country at Alpha buried in the sand under logs and hybernating behind a series of strong epiphragms. In this state many had been gnawed through and eaten by lizards and insects. Everywhere abundant; very variable in size.

Facing Island, Gracemere, Olsen's Caves, Coomooboolaroo, Alpha, Bogantungan, Calliungal, Dalgangal, Banban, Kilkivan, and North Pine River.

C. BREVIPILA, Pfeiffer.

Warro, Curtis Island, Mt. Archer and Cania.

C. BLACKMANI, Cox.

Scarce.

Miriam Vale, Warro.

HADRA ROCKHAMPTONENSIS, Cox.

Under loose bark.

Rockhampton.

var. PALLIDA, var.nov.

Bandless, of a tawny yellow colour.

Rockhampton.

Type in Australian Museum.

H. BLOMFIELDI, Cox.

Under loose bark; gregarious.

Miriam Vale, Rockhampton, Boobeyjan, Cania, Gympie, Kenilworth and Kilkivan.

var. WARROENSIS, var.nov.

We would thus distinguish the chestnut-coloured form from Warro, figured by Tapparone Canefri in the Malacologia of the Viaggio Magenta, pl. ii., fig. 5.

H. INCEI, Pfeiffer.

Under loose bark; gregarious. Varies much in size and

H. PACHYSTYLA, Pfeiffer

Found on sandy ridges buried a few inches below the surface amongst the roots of bushes ; scarce.

Miriam Vale, Warro, Facing Island, Coomooboolaroo, Torsdale and Kilkivan.

var. DAEMELI, von Martens.

Examples from Boyne Island are even smaller than those described by von Martens from Cape York, measuring maj. diam. 28 mm., min. 23 mm., alt. 27 mm.

PAPUINA FUCATA, Pfeiffer.

Crawling on shrubs in a scrub.

Miriam Vale.

P. BIDWILLI, Pfeiffer.

None found alive, dead shells occurred plentifully in scrubs.

Gympie (a) and (b), Kenilworth and North Pine River.

*BULIMUS (?) BIDWILLI, Cox.

Taken alive from leaves of trees in the scrubs ; scarce.

Miriam Vale, Warro.

STENOGYRA GRACILIS, Hutton.†

Under logs, gregarious, often buried in the ground, found hybernating beneath an epiphragm ; abundant and widely distributed.

Miriam Vale, Warro, Rodds Bay, Boyne Island, Facing Island, Curtis Island, Mt. Archer, Gracemere, Olsen's Caves, Bogantungan, Coomooboolaroo, Calliungal, Cania, Dalgangal, Banban, Kilkivan, and North Pine River.

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* We submit that this is a *Papuina* allied to *fucata* and *conscendens*.

† This name of Hutton's published in 1834 (Journ. Asiat. Soc. Bengal, iii., p. 93) preceded by several years Pfeiffer's names of *subula*, *tuckeri*, etc., etc. No snail could more truthfully apply to its species Macaulay's lines,—" By many names men call us ; In many lands we dwell."

TORNATELLINA EUCHARIS, Brazier.

One example from Warro and two from Boyne Island were kindly determined for us by the conchologist who described the species.

P. PEDICULA, Shuttleworth.

Under stones and logs, and dead in river rubbish.

Miriam Vale, Warro, Boyne Island, Facing Island, Curtis Island, Gracemere, Bogantungan, Calliungal, Torsdale, Cania, Dalgangal, Banban and Kilkivan.

P. PACIFICA, Pfeiffer.

Under stones and logs in the open country; abundant.

Rodds Bay, Facing Island, Gracemere, Bogantungan, Calliungal, Torsdale, Cania, Kroombit, Banban, Gympie and North Pine River.

hand denies us the opportunity of dwelling upon its characteristics and affinities, but it cannot at any rate be confused with any other Australian mollusc.

Cœliaxis australis, Forbes.

Under logs and stones, &c., in scrubs; from a square yard of ground 150 specimens were obtained. Very local.

Warro, Cania and the North Pine River.

Succinea arborea, Adams and Angas.

Under bark on trees; common.

Rodds Bay, Curtis Island, Gracemere, Boobeyjan, Dalgangal and Kilkivan.

S. strigata, Pfeiffer.

Not common.

Jericho, Bogantungan, Coomooboolaroo, Dalgangal, Torsdale, Banban and Kenilworth.

Aneitea graeffei, Humbert.

Miriam Vale, Kilkivan and North Pine River.

Georissa multiliriata, Brazier.

Olsen's Caves, plentiful on the rocks; Cania, in a Birds-nest-fern (*Asplenium nidus*).

Pupina coxi, Morelet.

Under stones in scrubs.

Olsen's Caves (c), Cania Station and Coomooboolaroo.

P. costata, n.sp.

Shell costate, umbilicate, narrowly ovate, solid; colour ?; whorls 5½, rounded, the last slightly descending at the aperture, comprising half of the total length of the shell and equalling its

predecessor in width; spire regularly tapering; apex obtuse; sculpture close, oblique, sharp, threadlike longitudinal riblets, the first 2 whorls smooth, the third lightly ribbed; suture deeply impressed; umbilicus spiral, wide and shallow externally, deep and narrow within, ridged around the margin; aperture almost detached from the body whorl, vertical, circular, furnished with but one canal, which is small, shallow, and cut half across the left side of the peristome, its position coinciding with the termination of the circum-umbilical ridge, peristome reflected and expanded, broad anteriorly, narrow near the body whorl. Operculum not collected. Length 6, breadth 3 mm.

Hab.—Rejectamenta of a stream nine miles north of Gympie and at Calliungal; dead shells only (Musson).

Type in Australian Museum.

[redacted]

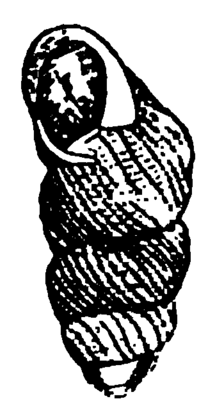
P. STRANGEI, Pfeiffer.

Under logs and leaves in scrubs; common.

Miriam Vale, Three Moon Creek, Cania, Dalgangal, Banban, Kilkivan, Gympie and the North Pine River.

DIPLOMMATINA EGREGIA, n.sp.

Shall dextral, umbilicate, elliptically ovate, thin, translucent; colour, shell white beneath an amber epidermis; whorls $5\frac{1}{2}$ regularly increasing, slightly convex, flattened beneath the suture, the last exceeding in length the remainder, slightly ascending at the aperture; sculpture, numerous, small, slightly raised, oblique ribs, of which there are about forty on the body whorl, becoming closer as the whorl proceeds, on the antepenultimate there are few, and on the earlier none, between the ribs microscopically, regularly, spirally striated; suture impressed; apex obtuse; umbilicus narrow and deep; aperture scarcely oblique, oval, rounded below, right margin of peristome narrow at the point of insertion, becoming wider and more reflected as it approaches the columella, the latter widely reflected over the perforation and terminating abruptly above, body whorl overlaid within the aperture by a slight callus. Operculum not collected. Alt. $3\frac{1}{3}$, breadth $1\frac{1}{2}$ mm.



Hab.—Calliungal (Musson); dead shells only.

Type specimens are deposited in the Australian Museum.

This species belongs to the subgenus *Arinia*, of H. and A. Adams; it has no ally in the Australian fauna, but approaches *D. minus*, Sow., and *D. scalatella*, Dohrn, from Luzon in the Philippines.

HELICINA DIVERSICOLOR, Cox.

Under stones; fairly plentiful.

Miriam Vale, Warro, Kilkivan, Gympie, Kenilworth and North Pine River.

H. GLADSTONENSIS, Cox.

Under stones in damp and shady places; widely distributed and fairly plentiful.

Miriam Vale, Mt. Archer, Olsen's Caves, Calliungal, Cania, Dalgangal, Banban, Kilkivan, and Gympie (a).

LIMNEA LESSONI, Deshayes.

Variable, plentiful, and widely distributed.

Miriam Vale, Warro, Gracemere, Rockhampton, Jericho, Torsdale, Cania, Dalgangal and Banban.

var. ANGASI, Sowerby.

Durundu.

BULINUS BEDDOMEI, Nelson and Taylor.

Plentiful and variable.

Rockhampton.

[redacted]

B. PRYAMIDATUS, Sowerby.

Gracemere.

B. FUSIFORMIS, Nelson and Taylor.

Facing Island.

The above forms of *Bulinus* are recorded, but the writers do not endorse their claims to specific rank, which in some instances are extremely shadowy. Upon few genera has synonymy, that curse of Babel upon science, fallen heavier than upon the Australian Bulinus. The bewildering multiplicity of names applied to a few protean forms needs most careful sifting by a local student; any foreign author who should attempt the task with but a handful of material would make confusion worse confounded.

ANCYLUS AUSTRALICUS, Tate.

Torsdale.

PLANORBIS GILBERTI, Dunker.

Plentiful.

Miriam Vale, Gracemere, Coomooboolaroo, Bogantungan, Calliungal, Cania and Banban.

SEGMENTINA VICTORIÆ, E. A. Smith.

Coomooboolaroo, Calliungal and Banban.

MELANIA TATEI, Brazier.

Miriam Vale, Warro, Gracemere, Jewel Creek, Rockhampton, Coomooboolaroo, River Medway, Bogantungan, Lake Victoria, River Dee, Calliungal and Banban.

M. DENISONIENSIS, Brot.

Jewel Creek, Rockhampton.

M. QUEENSLANDICA, E. A. Smith.

Colosseum Creek, Miriam Vale.

HYDROBIA BRAZIERI, E. A. Smith.

River Barambah at Banban, Calliungal.

BYTHINIA TRYONI, E. A. Smith.

Three Moon Creek and Dalgangal.

LARINA STRANGEI, A. Adams.

Banban.

VIVIPARA SUBLINEATA, Conrad.

Jordan Creek, Jericho. Two specimens.

V. ESSINGTONENSIS, Shuttleworth.

Scrubby Creek, Gracemere, Rockhampton, Coomooboolaroo and Kroombit Creek.

SPHÆRIUM QUEENSLANDICUM, E. A. Smith.

Colosseum Creek, Miriam Vale, Curtis Island, Coomooboolaroo and Calliungal.

CORBICULA OVALINA, Deshayes.

Rockhampton, Scrubby Creek, Gracemere, Lake Victoria, River

[redacted]

DESCRIPTIONS OF SOME NEW SPECIES OF PULMONATE MOLLUSCA FROM AUSTRALIA AND THE SOLOMON ISLANDS.

By J. C. Cox, M.D., F.L.S.

(Plates xx. and xxi.)

Helix (Hadra) oscarensis, n.sp.

(Pl. xx., figs. 6 and 7, enlarged twice).

Shell lenticular; of a dull lustrous opaque cretaceous pale cream colour, except the three apical whorls, which are of a dark yellowish-brown hue, and this deepening of colour in a less degree is manifested in a few irregular-sized spaces across the whorls (not sufficiently shown in fig. 6). Whorls six; very gradually increasing in size; irregularly, but closely, rather coarsely, transversely, arcuately striate, with lines of growth becoming less distinct on the three apical whorls as they approach the apex; the whorls are flatly slanting, not so rounded as fig. 6 would lead to suppose, smoother below the periphery of the last whorl than above; last whorl sub-acutely keeled at the periphery, the keel is white and opaque, margining the periphery of the last whorl before reaching the peristome, causing it to be rather acutely angled; immediately below the peripheral carinal edge of the last whorl, the colour of the shell is darker than the rest of the lower half of the whorl. With the mouth away from one, as shown in fig. 7, the shell is seen to have a deep open umbilicus, more so than is represented in fig. 7, about one-third of it being overlapped by an expanded columella; the peristome is simple, everted and slightly expanded; aperture roundly lunate, darker within than at the internal edge;

upper margin of the peristome inserted into the carinal margin of the periphery of the last whorl; columella triangularly expanded, white and smooth, no trace of a callous expansion between the ends of the peristome on the body whorl. The suture of the whorls is well impressed, margined above with a faint opaque white line, a continuation of the carinal margin of the periphery. The apex shows no signs of a granular sculpture. Diam. maj. 20, min. 17, alt. 14 mm.

Hab.—The Oscar Ranges, 20 miles from the Barrier Ranges, West Australia (*Froggatt*).

Type in the Macleay Museum.

HELIX (HADRA) DERBYI, n.sp.

(Pl. xx., figs. 4 and 5.)

Shell depressedly globose; whorls $5\frac{1}{2}$ to 6, very gradually increasing, with a moderately large open deep umbilicus, more so than is represented in fig. 5, the periphery of the last whorl is smoothly rounded to the aperture; colour light brown, marbled with lighter patches, but not regularly across the whorls; surface strongly but irregularly transversely striated with curved lines of growth, the convexity of the curves being upwards. Apex very slightly raised; last whorl deflected at its termination; the periphery is margined by a narrow pale band, but in no way carinated, aperture elongately lunate, the right margin inserted below the centre of the periphery of the preceding whorl, the columellar margin with a slight expansion at its insertion, the edge of the peristome very slightly everted and thickened. Apical whorl quite smooth. The base of the shell is convex, more faintly striated than the upper surface, of a lighter colour and not marbled. Whorls rounded, suture deep and well defined, but not margined. Diam. maj. 11, min. 9, alt. 6 mm.

Hab.—The Derby District, Barrier Ranges, Western Australia (*Froggatt*).

Type in the Macleay Museum.

[redacted]

BULIMUS (PLACOSTYLUS) HOBSONI, n.sp.

(Pl. xx., figs. 2 and 3.)

Shell deeply and openly rimate, comparatively thin and light for its size, translucent, the sculpture and markings are very visible on the body whorl through the wall of the shell by transmitted light; shining and lustrous, of a light reddish-brown colour, the whorls of the spire becoming lighter in shade and more of a pinkish-brown; ornamented with many irregularly sized and irregularly distributed chestnut-coloured tentoriform markings; whorls slightly inflated, causing the suture to assume an impressed character. Suture margined by a narrow opaque slightly raised knotted selvaged margin (not smooth and straight as represented in the figures); whorls longitudinally irregularly marked with lines of growth and transversely subcostately ridged with rather coarse raised undulating lines, which frequently anastomose (a character quite omitted in the figures, but which is very characteristic), becoming much less distinct on the whorls beyond the body whorl, till, on the third whorl from it, they are almost invisible, and are gradually replaced by a granular punctation, which increases in distinctness quite to the apex; these granular punctures are disposed in two distinct transverse slanting rows, one running from right to left, the other from left to right. Aperture oblong-ovate, of a pinkish-brown colour; peristome only slightly thickened and everted, pinkish-brown throughout, except at the columella which is of an opaque white only very faintly tinged with pink-brown; columella broadly expanded and dividing at its insertion, as in all the shells of this group, into two processes, the outer and smallest gradually blending with a thin transparent glassy callus, which runs towards the insertion of the upper end of the peristome, which is rather arched out from the side of the shell as it leaves its insertion (more so than is represented in the figure), the larger process of the divided columella enters spirally the interior of the shell. In the several specimens of this species which I have seen, there is no disposition to the formation of a

callosity or tooth on the body whorl in the aperture between the inserted ends of the peristome. Length 58, breadth 27 mm.

Hab. Malanta Island, Solomon Islands (*Hobson*).

Type in my collection.

When first presented with specimens of this shell, I was inclined to look upon it only as a variety of my *Bulimus scotti*, described in the Proc. Zool. Soc. of London of 1873, page 152; but the examination of more recent additions to my collection, and of the specimens in Mr Hodgson's cabinet indicates that they are worthy of separation. It is difficult to light on characters of this fine group of shells which are specially occupants of the South Pacific Islands, not including New Guinea. Their great holdfast appears to be the Fiji and Solomon groups proper, a few coming from the New Hebrides and other groups. This is a question which is well worthy of being worked out. The group is in all instances characterised by granular punctation of the apex, but the punctation is not alike distributed in all cases, as a rule, it is in transverse rows. Another character quite separates the group into two divisions, one is smooth, only showing longitudinal lines of growth on the body whorl, the other division is invariably transversely sculptured, with more or less straight rugæ, in some instances taking on more the character of lineations than of ridges.

HEDLEYA MACLEAYI, gen. et sp.nov.

(Pl. XXI., figs. 2, 5, 8, and 10.)

Shell dextral, imperforate, thin, translucent, elongate, subcylindrical, slightly tapering and blunt at the apex. Colour amber. Whorls $8\frac{1}{2}$, tumidly inflated, gradually increasing, the last comprising nearly one third of the total length. Sculpture, numerous, tolerably regular, close, slightly curved, scarcely oblique, sharp, erect ribs, of which about 45 ornament the final whorl; they are not continuous from whorl to whorl, do not anastomose, and are separated by smooth interstices of two or three times their breadth; on the upper whorls these ribs grow weaker and closer, until they fade away on the second and third whorls; across the ventral

surface of the body whorl a deep dint (as of a groove worn by a rope in wood) extends obliquely for a quarter of the circumference of the shell and occupies the central third of the space between the suture and the insertion of the columella. Suture deeply impressed. Apex smooth, depressed, first whorl discoidal, first two and a-half hemispherical. Aperture oblique, effuse anteriorly, in outline distorted rhomboid, square anteriorly (not rounded as in the figure), angled posteriorly; peristome strongly thickened and reflected throughout, callus on body whorl thin, transparent, not defined at its limit and would scarcely be perceptible but for the microscopically granulated surface which it shares with the columella; columella straight, continued from the base in the direction of the axis of the shell, then sharply doubling by a sigmoid flexure around the orifice of the anterior canal; this canal presents exteriorly an arched ridge parallel to the columellar margin and divided therefrom by a deep and narrow groove resembling an umbilical crevice; the position of the obsolete posterior canal is marked by a small entering callous ridge (not shown in my illustration) near the posterior angle of the aperture. Length 8¼, breadth 2 mm.

Hab.—Cairns, North Queensland (*Froggatt*).

Type in the Macleay Museum and in my collection.

Generic characters should be derived from more than one species and from more knowledge of the mollusc than the naked shell affords. Awaiting anatomical details of the animal and the discovery of fresh species in the unexplored wilds of Northern Queensland, Papua, and Malaysia, I will leave conchological students to construct a generic diagnosis, if they require one, from the foregoing description of the type. Merely will I premise that *Hedleya*, so-called in compliment to my friend Mr. C. Hedley, F.L.S., is undoubtedly an aberrant member of the Pupinidæ, as indicated by its anterior and posterior canals; whilst their unusual position and development, and especially the peripheral scrobiculation on the body whorl, effectually sunder it from all known forms.

I have to apologise for the illustrations I offer of this shell, which are far from good, and should be interpreted with the corrections conveyed in the description. The outline, fig. 10, represents the shell of the natural size; fig. 5 is magnified three, and figs. 2 and 8 six diameters, respectively.

The large central figure on Pl. xx., fig. 1, is the animal of *Bulimus MacConnelli*, Reeve.

Fig. 9 on Pl. xxi. is a very faithful representation of the animal of *Cœliaxis australis*, Forbes, = *Balea australis*, Forbes.

Figs. 4 and 7 are enlarged figures of the young state of *Cœliaxis* before decollation has occurred. I wish to draw special attention to the enlargement of the second whorl in this stage of development. I find from observation that it is this enlargement which first shows signs of dissolution and which ends in decollation.

The carbonate of lime, of which this thickened whorl is composed, is more exposed to the carbonic acid held in solution in the damp localities which this species inhabits, than the other whorls are; its prominence causes the epidermis to be early worn off it, being exposed, the carbonic acid in solution more readily acts on the insoluble carbonate of lime composing it, and converts the insoluble carbonate into a soluble bicarbonate. The erosion, as far as I have been able to observe from specimens kept in a box of damp sand, never begins in the apex; the apex really drops off when this nodose second whorl becomes dissolved. What purpose this enlargement of the second whorl serves in the economy of the young is difficult to conjecture; it may be that its increased weight in the early developmental stage would cause it to lie flat beside the animal, and in this way would be less exposed to injury as the animal glides about; or it may be for increased strength for protection.

[redacted]

DESCRIPTION OF A NEW DIPLOMORPHA.

By W. D. Hartman, M.D.

(Communicated by J. C. Cox, M.D., F.L.S.)

(Plate xxi., figs. 1, 3, and 6.)

Diplomorpha Coxi, Hartm.

Shell ovate, thick and stout, body whorl inflated, apex acute; whorls 4½, rounded, suture impressed, body whorl nearly two-thirds the length; transverse striæ coarse; epidermis absent. Colour a soiled white, with the apical whorls a pale reddish-saffron colour, labium white, widely reflected, thick, and slightly revolute, with a heavy deposit on the pillar lip. Umbilicus open, exhibiting one revolution, aperture a soiled white, with a reddish colour within the inner margin of the labium. L. 27, D. 15, L. apt. 10, D. apt. 6 mm.

Hab.—Aneiteum, New Hebrides (Dr. Cox, per S. Raymond Roberts).

Obs.—Some ten years ago Dr. Cox sent me this shell, which I returned to him as unknown. At that time I was unacquainted with the genus. Since then I have possessed all the species, and I take great pleasure in associating this fine shell with the name of one who has done so much for the science of conchology.

SOME NEW SOUTH WALES PLANTS ILLUSTRATED.

(No. I.)

By R. T. Baker, Assistant Curator, Technological Museum, Sydney.

(Plate xxxvii.)

Acacia prominens, A. Cunn. in G. Don, Gen. Syst. ii. 406, B.Fl. ii. 371.

One of the first signs of the wattle-flowering season around [redacted]

[redacted]

As there is no necessity to re-publish what in Bentham's description the plate fully bears out, I will only state in what respects it differs somewhat, owing to the variability of the species.

It is described as "a tall shrub," but it is very often to be seen over 20 feet, and not uncommonly exceeding 30 feet in height, with a diameter in proportion.

The phyllodes often extend to 2 inches, particularly in plants found in the northern districts; about 1½ inches in those in the neighbourhood of Sydney, and 1 inch in southern examples.

The racemes are given by Bentham as "about as long as" the phyllodes, but I find them almost always longer in the living state. They shrink very much in drying.

The pod ("neglected by collectors in the majority of specimens gathered") can scarcely be said to be "very flat"; it is light warm-brown in colour, glabrous and rugose; measuring 1 to 3 inches long and ¼ to 1 inch broad.

The seeds are at first transverse, but in some cases oblique and longitudinal, along the centre; they appear to change their position prior to falling.

The coloured plate (Bot. Mag., Vol. LXIII., No. 3502) in no way assists to identify the species.

EXPLANATION OF PLATE.

PLATE XXXVII.

Branchlet collected at Canterbury, near Sydney, Aug. 1891 (nat. size).

Fig. 1.—Unexpanded flower (enlarged).
Fig. 2.—Expanded flower (enlarged).
Fig. 3.—Pistil (enlarged).
Fig. 4.—Various views of a stamen (enlarged).
Fig. 5.—Pollen grain (enlarged).
Fig. 6.—Twig with pod (Hurstville) (nat. size).
Fig. 7.—Pod from Snowy Mountains (nat. size).
Fig. 8.—Seed (enlarged).
Figs. 9 and 10.—Extreme forms of phyllodes (nat. size)

NOTES AND EXHIBITS.

Mr. W. S. Duncan sent for exhibition an interesting collection of land and freshwater Mollusca, comprising twenty-two species, obtained in the neighbourhood of Inverell, N.S.W. A list of them, numbered as sent, determined by Mr. C. Hedley, with localities and remarks, is as follows:—

1. *Rhytida capillacea*, Férussac.
   Hab.—Five miles from Inverell, in basalt country.
2. *Hadra liverpoolensis*, Brazier.
   Hab.—Generally distributed.
   The black and red soils have corresponding effects on the living shell of this species; the colour soon fades after the animal has been extracted.

11. *Pupa pacifica*, Pfeiffer.
  Hab.—Generally distributed.

12. *Pupa pedicula*, Shuttleworth.
  Hab.—Generally distributed.

13. *Pupa pedicula*, Shuttleworth.
  Hab.—Generally distributed.

14. *Succinea arborea*, Adams and Angas.
  Hab.—Little Plain, fifteen miles from Inverell.
  This genus is very poorly represented up here; this is the only species I can find a trace of, and that rarely.

15. *Corbicula prolongata*, Prime.
  Hab.—McIntyre River.

16. *Corbicula nepeanensis*, Lesson.
  Hab.—McIntyre River.

17. *Limnea lessoni*, Deshayes.
  Hab.—Big River, The Gwydir.

18. *Bulinus proteus*, Sowerby.
  Hab.—McIntyre River.

19. *Bulinus brazieri*, Smith.
  Hab.—McIntyre River.

20. *Bulinus brazieri*, Smith.
  Hab.—McIntyre River.

21. *Bulinus gibbosus*, Gould.
  Hab.—McIntyre River.

22. *Bulinus* sp.
  Hab.—Waterhole near Big River.

23. *Melania balonnensis*, Conrad.
  Hab.—McIntyre River.

24. *Planorbis brazieri*, Clessin.
  Hab.—Big River, Beverley.
  Uncommon.

25. *Ancylus australicus*, Tate.
  Hab.—McIntyre River.
  Uncommon.

26. *Unio australis*, Lamarck.
  Hab.—McIntyre River.

Mr. Hedley exhibited, on behalf of Mr. Whitelegge, and read the following note on specimens of a species of *Glaucus* frequently washed ashore on the coast:—"A species of *Glaucus* is frequently washed ashore on the coast of N.S.W., the determination of which puzzled myself and my scientific friends. The Monograph of this genus in the Challenger Reports quotes several species whose illustrations and descriptions occur in works of which no copies exist, so far as I am aware, in Australia. On being favoured by Mr. Whitelegge with some fine specimens collected by him at Maroubra Bay, near Sydney, I referred them to Prof. Dr. R. Bergh, of Copenhagen, the highest authority on this and other orders of nudibranchiate mollusca. Dr. Bergh replied to my enquiries with his usual kindness and courtesy, and as such information may be of equal service to my fellow students, the following extract from his letter is here given:—'I have examined the Glauci you sent. According to the anatomy the animal is absolutely the circum-equatorial *Gl. atlanticus*, Forster. The drawing you sent seems to represent the varieties of the species

[redacted]

Dr. Cox exhibited specimens of the British snail, *Helix (Xerophila) ericetorum*, Müller, naturalised in Australia; the shells were found in grass tussocks at "Levens," about 12 miles west of Warooka, York's Peninsula, S. Australia; the species was probably imported with some English grass seed which a few years ago was there cultivated; but this appears to be the first recorded instance of its occurrence in Australia. Also drawings and specimens of mollusca in illustration of his paper.

Mr. Froggatt sent for exhibition a collection of Hymenoptera—about 100 species—recently obtained by him at Ballarat, Victoria; a large *Tipula* from Rose Bay; and some Homopterous galls of both sexes, probably of a small variety of *Brachyscelis ovicola*, Schr., from Wollongong, together with two species of parasitic Hymenoptera—one of them with a curiously developed last abdominal segment—bred from the female galls.

Mr. Baker exhibited specimens of *Acacia prominens* from various localities in illustration of his paper.

Mr. Fletcher read a note, in reply to Dr. Dendy's recent article on the supposed oviparity of *Peripatus leuckartii* (Victorian Naturalist for September, Vol. viii., No. 5, p. 67), in which he pointed out that whatever the Victorian *Peripatus* might be (whether oviparous as Dr. Dendy supposes; or like *P. novæ-Zealandiæ*, though viviparous occasionally laying eggs which, however, do not hatch, as observed by Prof. Hutton and corroborated by Mr. Sedgwick), *Peripatus*, as it occurs in N.S.W., is certainly viviparous; and in support of his statement he exhibited a series of twenty-eight embryos, just those which had come under his notice in the dissection of two or three females, or had been extruded during the drowning of several others, and comprising specimens old enough to show the full number of developing post-oral appendages up to individuals whose development is so nearly complete that they must have been within a very brief period indeed of birth; even without actual witness of parturition he thought the evidence adduced was conclusive.

Mr. Trebeck showed some caterpillars destructive to vegetation from a garden at North Shore.

Mr. F. Turner exhibited fruits and seeds of the Sweet Cassava of Brazil (*Manihot Aipi*, Pohl), grown on the Clarence River by Mr. J. Marchant; fruits and seeds of *Sterculia acuminata*, Beauv., the famous Cola Nut, from Sierra Leone; and the fruits of *Emex australis*, Stienh., a really dangerous weed, probably introduced from the Cape of Good Hope, which has become established in several places in N.S.W.

Baron von Mueller sent for exhibition a large selection from the plants from Prince Regent River, described or recorded in his paper, the same to be afterwards added to the Society's herbarium Also a specimen of *Hypoestes moschata*, F.v.M. and Holze. remarkable for its musky odour; habitat, some distance inland from Port Darwin.

WEDNESDAY, OCTOBER 28TH, 1891.

The President, Professor W. A. Haswell, M.A., D.Sc., in the Chair.

DONATIONS.

"Agricultural Gazette of N.S.W." Vol. ii., Part 8 (August, 1891). *From the Director of Agriculture.*

"Reichenbachia—Orchids illustrated and described." By F. Sander. Second Series. Vol. i., Part 6; "Stettiner Entomologische Zeitung." 52 Jahrg., Nos. 1-3 (1891). *From the Hon. Sir William Macleay, M.L.C., F.L.S.*

"Zoologischer Anzeiger." xiv. Jahrg., Nos. 371 and 372 (August-September, 1891). *From the Editor.*

"Nova Acta Regiæ Societatis Scientiarum Upsaliensis." Third Series. Vol. xiv., Fasc. ii. (1891). *From the Society.*

"Proceedings and Transactions of the Royal Society of Canada for the year 1890." Vol. viii. *From the Society.*

U.S. Department of Agriculture—Division of Entomology—"Insect Life." Vol. iii., Nos. 11 and 12 (August, 1891). *From the Secretary of Agriculture.*

"Smithsonian Institution—U.S. National Museum—Proceedings." Vol. xiv., Nos. 852-855, 857, and 862-863 (1891); "Bulletin." No. 39, Parts B-E (1891). *From the Museum.*

"Bulletin of the American Museum of Natural History." Vol. iii., No. 2, one sheet (pp. 307-322) (August, 1891). *From the Museum.*

"Reprints of Three Editorials regarding the priority in demonstrating the Toxic Effect of Matter accompanying the Tubercle Bacillus and its Nidus." (1891). *From the Bacteriological Laboratory, Academy of Natural Sciences of Philadelphia, U.S.A.*

"Bulletin of the Museum of Comparative Zoology at Harvard College." Vol. xxi., No. 5 (June, 1891). *From the Curator.*

"Records of the Geological Survey of India." Vol. xxiv., Part 3 (1891). *From the Director.*

"Gesellschaft für Erdkunde zu Berlin—Verhandlungen." Band xviii. (1891), No. 6; "Zeitschrift." Band xxvi. (1891), No. 3. *From the Society.*

"The Victorian Naturalist." Vol. viii., No. 6 (Oct., 1891). *From the Field Naturalists' Club of Victoria.*

"Records of the Australian Museum." Vol. i., No. 9 (Oct., 1891). *From the Trustees.*

PAPERS READ.

REVISION OF AUSTRALIAN LEPIDOPTERA.

By E. Meyrick, B.A., F.Z.S.

V.

The present paper practically concludes the Australian *Geometrina*, except in so far as future discoveries may produce fresh material. The alterations of generic nomenclature which will be found in it, and the substitution of the family name *Selidosemidae* for *Boarmiadae*, are necessary, and will be understood by reference to my paper on the classification of the European *Geometrina*, which will, I hope, appear in the Transactions of the Entomological Society of London for the current year. Hence I shall not in general discuss them here.

The classification of the *Selidosemidae* is difficult, owing to the fact that in this family many structural characters are often different in closely allied species, and others vary greatly within the limits of the same species. Much judgment is therefore required in selecting suitable points on which to lay stress for distinction, so that the genera may be at once definable and natural. The results given are the outcome of considerable labour, and I think will be found satisfactory on the whole; but in some instances too little material has been available to make sure of accuracy. The neuration is in some genera very variable, in others constant, but I have in all cases examined every specimen that could be obtained; where variation has been found, it is always mentioned.

SELIDOSEMIDAE.

Ocelli and maxillary palpi usually obsolete. Forewings with vein 5 rising midway between 4 and 6, parallel, 7 and 8 rising out of 9. Hindwings with frenulum developed; vein 1c absent, 5 obsolete or reduced to a thickened fold, not tubular, 8 free or connected to cell at a point only.

A very large and cosmopolitan family. The group of which *Chlenias* may be considered the type is more developed in Australia than in any other region, and may be regarded as endemic and characteristic; yet even here it has evidently suffered much loss, and is now comparatively fragmentary; whilst the group of *Selidosema*, dominant in all regions but probably much later in reaching Australia, has already developed numerous endemic and connected forms, and has largely taken the place of earlier types.

In the following tabulation of genera 38, *Neoteristis* and 39,

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2.	Forewings in ♂ with well-marked fovea	3.
	Forewings in ♂ without defined fovea...	10.
3.	Antennal joints with two pectinations or teeth on each side.....................	4.
	Antennal joints with one pectination on each side..................................	5.
4.	Face with long projecting tuft of scales	4. *Osteodes.*
	Face without defined tuft..................	14. *Ectropis.*
5.	Fovea surmounted by a small distinct gland..	6. *Cosymbia.*
	Fovea without accessory gland...........	6.
6.	Face with strong horny prominence......	7. *Scioglyptis.*
	Face without horny prominence..........	7.
7.	Femora hairy beneath.........................	9. *Lophodes.*
	Femora glabrous.........	8.
8.	Thorax hairy beneath.........................	8. *Selidosema.*
	Thorax only slightly hairy.	9.
9.	Forewings with vein 10 absent...........	2. *Diastictis.*
	Forewings with vein 10 present...........	3. *Hyposidra.*
10.	Antennal pectinations continued to apex	11.
	Antennal pectinations not continued to apex.............	23.
11.	Thorax with triangular anterior or central crest.............................. ..	12.
	Thorax without such crest (but sometimes a bifid posterior crest)............	16.
12.	Thorax thinly or hardly hairy beneath	24. *Amelora.*
	Thorax densely hairy beneath...........	13.
13.	Forewings with vein 10 rising out of 9	14.
	Forewings with vein 10 rising separate	15.
14.	Anterior tibiæ with strong apical hook	28. *Criomacha.*
	Anterior tibiæ without apical hook	29. *Stathmorrhopa.*
15.	Forewings with vein 11 rising out of 10	33. *Smyriodes.*
	Forewings with vein 11 rising separate	32. *Chlenias.*

16. Abdomen crested near base .... 18. *Scardamia.*
    Abdomen not crested. .... 17.

17. Femora hairy beneath...................... 18.
    Femora glabrous............. .... 21.

18. Thorax with well-marked posterior crest 30. *Conosara.*
    Thorax without posterior crest........... 19.

19. Forewings with vein 10 connected with
    11....................................... .. 20.
    Forewings with vein 10 free from 11...27. *Mnesampela* (part).

20. Forewings with vein 11 connected with
    12........ .... 20. *Proboloptera.*
    Forewings with vein 11 free from 12.... 31. *Mictodoca.*

21. Female semiapterous . ... 12. *Hybernia.*
    Female winged............................. 22.

22. Forewings with vein 10 rising out of 9 19. *Rhinodia.*
    Forewings with vein 10 rising out of 11 22. *Metrocampa.*

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30.	Femora hairy beneath....................	31.
	Femora glabrous..........................	32.
31.	Forewings with vein 10 anastomosing with 9................................	21. *Idiodes.*
	Forewings with vein 10 not anastomosing with 9..........................	27. *Mnesampela* (part).
32.	Thorax densely hairy beneath............	33.
	Thorax slightly or not hairy..............	35.
33.	Forewings with vein 11 anastomosing with 12...............................	26. *Thalaina.*
	Forewings with vein 11 not anastomosing with 12............................	34.
34.	Forewings with vein 10 rising out of 11	11. *Aporoctena.*
	Forewings with vein 10 rising out of 9	10. *Melanodes.*
35.	Thorax with strong posterior crest.......	36. *Drymoptila.*
	Thorax without crest......................	36.
36.	Forewings with vein 11 running into 12	13. *Psilosticha.*
	Forewings with vein 11 not running into 12..	37.
37.	Forewings with vein 10 running into 9	15. *Tigridoptera.*
	Forewings with vein 10 not running into 9..	5. *Discalma.*

1. Epicompsa, n.g.

Face smooth. Tongue developed. Palpi moderate, porrected, slender, shortly rough-scaled, terminal joint short. Antennæ in ♂ bipectinated, towards apex simple. Thorax smooth, beneath nearly glabrous. Femora glabrous; posterior tibiæ in ♂ not dilated. Forewings in ♂ without fovea; veins 10 and 11 separate. Hindwings normal.

The single species is at present of somewhat uncertain affinity.

1. *Epic. xanthocrossa*, n.sp.

♂. 20 mm. Head and thorax rosy-whitish, face brownish. Palpi yellowish. Forewings with hindmargin oblique, thrice

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shallowly emarginate so as to form a short obtuse triangular projection on vein 6 and a broader one on vein 3; pale greyish-ochreous, becoming rosy-whitish towards costa, with a few scattered dark grey strigulæ; costa narrowly deep ochreous-yellow, with a few black dots; lines cloudy, dark grey, starting from strong oblique black costal strigulæ; first angulated on apex of strigula; second dentate, between costal strigula and middle curved outwards but nearly obsolete, on lower $\frac{2}{3}$ followed by a reddish-fuscous blotch nearly reaching hindmargin; an interrupted blackish hindmarginal line: cilia white, with a sharp fuscous line internally edged with ferruginous, externally forming spots on projections. Hindwings with hindmargin waved, angulated on vein 3; light reddish-fuscous, more greyish towards middle of hindmargin, and becoming pale greyish-ochreous towards base, with some scattered dark grey strigulæ; second line straight, somewhat irregular, cloudy, dark grey; hindmarginal line and cilia as in forewings.

[redacted]

Discal spot of forewings ochreous, edged with blackish.................... .... 2. *australiaria.*
Discal spot of forewings wholly dark fuscous 3. *margaritis.*

2. *Diast. australiaria*, Gn.

(*Halia australiaria*, Gn. X, 91; *Selenia apamaria*, Walk. 255; *Macaria remotaria*, ib. 938; *M. gratularia*, ib. 939; *M. infixaria*, ib. 939; *M. frontaria*, ib. 1652; *M. panagraria*, ib. 1653; *M. porrectaria*, ib. Suppl. 1659.)

♂♀. 27-32 mm. Antennal pectinations in ♂ 1½, very strongly ciliated. Forewings with hindmargin angularly projecting on vein 4, slightly in ♂, more strongly in ♀, upper half somewhat concave; vein 11 connected with 12 and 9; pale brownish-ochreous, sprinkled with dark fuscous dots or short strigulæ, and sometimes suffusedly irrorated with whitish towards disc and costa; first line slender, fuscous or dark fuscous, indented in middle, sometimes obsolete; a faint or indistinct fuscous median shade; a narrow transverse somewat irregular ochreous discal spot, strongly edged with blackish in ♂, less strongly in ♀; second line formed by a series of dark fuscous dots, nearly straight, bent near costa, sometimes obsolete; terminal area beyond this line in ♀ suffused with ferruginous-ochreous, except a triangular apical patch, which is edged anteriorly by a darker streak, which exists in ♂ also as a conspicuous short dark ferruginous-fuscous streak from costa. Hindwings rather strongly angulated on vein 4, more prominently in ♀; colour, median shade, and second line as in forewings; a cloudy dark fuscous discal dot, sometimes indistinct; terminal area beyond second line more brownish-tinged, with anterior margin of a faint subterminal line usually more or less indicated with ferruginous-ochreous.

Sydney, Bathurst (2300 feet), and Orange (3000 feet), New South Wales; Melbourne, Victoria; Launceston, Deloraine, and Hobart, Tasmania; from August to January, common amongst *Acacia decurrens*, on which the larva feeds. The species is variable, but not excessively so, though the difference in the sexes is rather marked.

3. *Diast. margaritis*, n.sp.

♂♀. 26 mm. Head, palpi, and thorax white, sprinkled with pale ochreous. Antennæ whitish, pectinations in ♂ 2½, stout. Forewings with hindmargin in ♂ hardly perceptibly, in ♀ more distinctly angulated on vein 4; vein 11 anastomosing with 12 and 9, or free; prismatic whitish, with short scattered cloudy dark fuscous strigulæ; costa and veins tinged with ochreous; first line and median shade straight, thick, dark fuscous, not reaching costa; a transverse dark fuscous discal spot before median shade; second line slender, blackish-fuscous, nearly straight, bent near costa; a series of white spots representing subterminal line, preceded by a ferruginous-ochreous suffusion nearly reaching second line, hindmarginal area beyond this pale brownish-ochreous: cilia pale brownish-ochreous, base white. Hindwings with hindmargin slightly angulated in ♂, rather prominently in ♀; colour and markings as in forewings, but first line and discal spot absent, subterminal white spots reduced or nearly obsolete.

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obliquely sinuate, waved; whitish-ochreous or pale yellowish-ochreous, irrorated with reddish-brown, in ♀ wholly suffused with reddish-brown; lines cloudy, dark reddish-fuscous, subdentate, first curved, second rather curved, sinuate towards extremities; median shade thick, cloudy, dark reddish-fuscous, somewhat curved and sinuate, space between this and second line in ♂ suffused with reddish-fuscous; second line followed towards costa by three cloudy somewhat confluent whitish spots, beyond which is a fuscous suffusion. Hindwings with hindmargin in ♂ waved, in ♀ crenate; in ♂ yellower, in ♀ as in forewings; median shade thick, reddish-fuscous, somewhat curved; second line cloudy reddish-fuscous, subdentate, somewhat curved, followed by a very obscure whitish line.

Cooktown, Queensland; two specimens (*Coll.* Lucas). Also from Java.

4. Osteodes, Gn.

Face with strong well-defined tuft of scales. Tongue developed. Palpi moderately long, porrected, rough-scaled, tolerably pointed, terminal joint concealed. Antennæ in ♂ bipectinated throughout with very short pectinations, a pair on each side of each joint, ending in long tufts of cilia. Thorax not crested, glabrous beneath. Femora glabrous; posterior tibiæ in ♂ slightly dilated. Forewings in ♂ with well-marked fovea; 10 rising out of 11, connected with 9 (or in exotic species absent), 11 anastomosing with 12. Hindwings normal.

Includes one Australian and one African species, which agree in all structural characters except the neural difference noted above, which does not seem to call for generic separation.

5. *Ost. procurata*, Walk.

(*Tephrina procurata*, Walk. 965; *Panagra ferritinctaria*, ib. 1002.)

♂♀. 25-27 mm. Forewings with hindmargin bowed; brown, sprinkled with short blackish strigulæ, and usually partially very finely irrorated with pale whitish-ochreous; costal edge sometimes

whitish-ochreous; first line somewhat irregular, usually nearly obsolete, sometimes preceded by a whitish-ochreous line or marked with blackish at lower extremity; median shade sometimes faintly darker; a blackish discal dot, sometimes obsolete; second line whitish-ochreous, often distinct in middle only, rarely throughout, slightly sinuate in middle, where it is preceded by a well-marked black dot, and followed by a more or less prolonged ferruginous suffusion, and sometimes also by a small blackish spot; generally two or three small blackish spots towards costa, indicating anterior margin of subterminal line. Hindwings with hindmargin bent on vein 4; pale brownish-ochreous or sometimes ferruginous-ochreous, more or less densely irrorated with fuscous; a dark fuscous discal dot; second line fuscous, bent in middle, usually indistinct; an irregular fuscous hindmarginal suffusion, with faint traces of a paler subterminal line.

Duaringa, Queensland; Sydney, New South Wales; Adelaide, South Australia; in October, November, April, and June, not [redacted]

not reaching costa; a fuscous transverse discal mark before median shade; second line strongly marked, nearly straight, dark fuscous, not reaching costa, preceded by a pale line, and followed by a light fuscous suffusion extending to costa; hind-marginal area fuscous-tinged. Hindwings with hindmargin rounded; colour and markings as in forewings, but first line and discal spot absent.

Queensland; two specimens in the British Museum. I possess one from New Guinea.

6. Cosymbia, Hb.

Face with short ridge or tuft of projecting scales. Tongue developed. Palpi moderate or rather long, porrected, rough-scaled, terminal joint moderate or short, loosely rough-scaled. Antennæ in ♂ bipectinated, extreme apex simple. Thorax not crested, slightly hairy beneath. Femora glabrous; posterior tibiæ in ♂ more or less dilated. Forewings in ♂ with well-marked fovea, surmounted by a small gland; 10 usually connected with 9, 11 out of 10 or absent (coincident), sometimes anastomosing with 12 and 10, or (if 11 absent) 10 sometimes connected with 12. Hindwings normal.

A rather small genus of wide distribution, occurring also in Europe, Asia, and Africa. It is a development of *Selidosema*, and is with difficulty separated from it in some instances, though in the Australian species the characteristic gland is sufficiently marked to leave no doubt.

1. Hindwings with discal dot...... .... 2.
   Hindwings without discal dot................. 9. *clarissa*.
2. Forewings with second line marked by a blackish streak......... .... 7. *rupicolor*.
   Forewings with second line not marked by a blackish streak.............................. 8. *penthearia*.

7. *Cos. rupicolor*, Butl.

(*Panagra rupicolor*, Butl., Trans. Ent. Soc. Lond. 1886, 437.)

♂♀. 32-34 mm. Antennal pectinations in ♂ 5, apical $\frac{1}{5}$ simple. Forewings with hindmargin gently bowed; pale brownish or

brownish-ochreous, strewn with small blackish strigulae, and sometimes sprinkled with whitish-ochreous; first line represented by a short blackish mark on inner margin; a large blackish discal dot; second line represented by a straight blackish streak extending from inner margin ⅔ across wing, margined with pale whitish-ochreous anteriorly, and sometimes suffused with fuscous posteriorly. Hindwings with hindmargin rounded, slightly bent on vein 4; colour, discal dot, and second line as in forewings, but second line less marked, and hardly reaching half across wing.

Duaringa, Queensland; Geraldton and York, West Australia; in November, six specimens. Probably this species (and very likely the other two also) extends right across the interior of Australia from east to west, without reaching either the north or south coasts.

8. *Cos. penthearia*, Gn.

(*Selidosema penthearia*, Gn. X, 146; *Tephrina adustaria*, Walk. Suppl. 1661.)

[redacted]

Duaringa, Queensland; three specimens received from Mr. G. Barnard.

7. Scioglyptis, n.g.

Face with strong conical or rounded-conical horny scaled prominence. Tongue developed. Palpi moderate, porrected, rough-scaled, terminal joint very short. Antennæ in ♂ bipectinated, apex simple. Thorax not crested, hairy beneath. Femora glabrous; posterior tibiæ in ♂ dilated, enclosing tuft. Forewings in ♂ with well-marked fovea; 10 sometimes connected with 9, 11 sometimes out of 10, sometimes anastomosing with 12. Hindwings normal.

An extreme form of *Selidosema*, only differing essentially by the peculiar frontal prominence; perhaps it need not be separated.

Frontal prominence acute............................ 10. *lithinopa.*
Frontal prominence obtuse.......................... 11. *hemeropa.*

10. *Sciogl. lithinopa*, n.sp.

♂. 27 mm. Frontal projection pointed, acute. Antennal pectinations 6, apical $\frac{1}{3}$ simple. Forewings with hindmargin obliquely rounded, somewhat waved; whitish-ochreous, with a few fine scattered blackish scales; first, median, and second lines slender, cloudy, fuscous, darker on veins, but very ill-defined, first curved and angulated near costa, median nearly straight, second curved inwards on lower $\frac{2}{3}$; an indistinct transverse discal mark beyond median line, appearing to connect median and second lines; subterminal faintly whitish, cloudy, hardly perceptibly darker-margined, preceded above middle by a small double dark fuscous spot. Hindwings with hindmargin rounded, waved; colour and markings as in forewings, but first line absent, no discal mark, median line darker, second line less curved inwards, nearly followed by a faint fuscous shade, subterminal line somewhat darker-margined anteriorly, preceded by a single very small fuscous spot above middle.

Brisbane, Queensland; one specimen received from Dr. T. P. Lucas. This specimen has vein 10 of the forewings connected

with 9, 11 rising out of 10, connected with 12; but the neuration may very possibly be as variable as in the next species.

11. *Sciogl. hemeropa*, n.sp.

♂♀. 28-32 mm. Frontal projection broadly rounded, obtuse. Antennal pectinations 3½, apical ⅔ simple. Forewings with hindmargin bowed; very pale whitish-ochreous or whitish-fuscous, with a few scattered black scales, and traces of darker strigulæ; basal area mixed with ochreous or fuscous; first line indicated by obscure ochreous or fuscous margins, angulated near costa; median shade ill-defined, ochreous or fuscous, sinuate; a black discal dot beyond it; second line faintly paler, dilated and more distinctly whitish on costal third, where it is margined anteriorly narrowly, and posteriorly broadly with ochreous, obtusely angulated on vein 5 and submedian fold, upper angle sometimes followed by a blackish spot, median third margined anteriorly with three ochreous or dark fuscous dots; a faint cloudy white waved sub- [redacted]

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marked fovea; 10 sometimes connected with 9, 11 sometimes out of 10, sometimes anastomosing with 12, sometimes absent (coincident with 10). Hindwings normal.

A large and cosmopolitan genus, of which the species are sometimes difficult to determine, owing to their obscure and similar colouring. The structural differences and the colour of the face should be carefully observed, and often give easy distinguishing characters. The neuration varies considerably; in Australia the species fall naturally into two groups, in one of which veins 10 and 11 are stalked or coincident, whilst in the other they are separate, and I formerly supposed that these groups could be maintained as distinct genera, but a wide study of exotic species of the genus has shown me that in them the two types of structure not unfrequently occur in different individuals of the same species; hence their discrimination is impossible.

In the following tabulation *S. despicata* is not included, as its characters are insufficiently known; it is an inconspicuous brownish species, without any striking points. Owing to insufficiency of material, I cannot be positive that the characters on which stress is laid in the tabulation are constantly reliable, and care should always be taken to note the several points of difference which usually occur between any two species, and not to depend on one exclusively; the specific separation of these insects will then be found easier than is supposed.

1.	Forewings with veins 10 and 11 separate	2.
	Forewings with veins 10 and 11 stalked or coincident.............................. ...	7.
2.	Face wholly blackish.........................	38. *argoplaca.*
	Face not wholly blackish....................	3.
3.	Antennæ in ♂ with apical $\frac{1}{6}$ simple.......	37. *euboliaria.*
	Antennæ in ♂ with apical $\frac{2}{5}$ or more simple..	4.
4.	Face with broad blackish median bar......	5.
	Face with blackish median bar incomplete or obsolete.......................................	6.

5.	Forewings with black discal dot...........	39. *bitaeniaria.*
	Forewings with raised white grey-edged discal mark............	40. *acaciaria.*
6.	Forewings clouded with pale reddish-ochreous.................................. ...	41. *illustraria.*
	Forewings not clouded with reddish-ochreous...	42. *episticta.*
7.	Hindwings whitish, much paler than fore-wings.........	8.
	Hindwings not much paler than forewings	9.
8.	Forewings with clear whitish blotch beyond second line.........	23. *capnota.*
	Forewings without whitish blotch	22. *exprimataria.*
9.	Face without dark markings, except scattered scales.....	10.
	Face more or less marked with blackish or dark fuscous.	15.
10.	Forewings with groundcolour white.... ..	26. *leucoplecta.*
	Forewings with groundcolour not white..	11.
11.	Wings distinctly yellowish-tinged	12.
	Wings not yellowish.........................	13.
12.	Forewings with median shade obsolete. ..	14. *amphiclina.*
	Forewings with median shade tolerably distinct..	34. *destinataria.*
13.	Forewings with second line whitish	13. *chaleuta.*
	Forewings with second line not whitish..	14.
14.	Hindwings with hindmargin dentate.....	31. *adelphodes.*
	Hindwings with hindmargin waved.......	15. *eremias.*
15.	Head wholly blackish	35. *zascia.*
	Head not wholly blackish.........	16.
16.	Face wholly dark fuscous except upper and lower margins....	17.
	Face not wholly dark fuscous..............	26.
17.	Forehead white or whitish	18.
	Forehead not whitish........................	23.

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18. Forewings with second line followed by ochreous-brown shade.................. .. 19.
Forewings with second line not followed by ochreous-brown shade .... 20.

19. Undersurface pale yellowish .... 21. *lyciaria.*
Undersurface not yellowish........ .... 12. *silicaria.*

20. Forewings with first line obsolete on upper half......... .... 25. *leptodesma.*
Forewings with first line marked throughout..................... .... 21.

21. Forewings with second line strongly dentate beneath costa............ . ... 20. *canescaria.*
Forewings with second line not strongly dentate beneath costa.................... 22.

22. Hindwings with hindmargin dentate...... 18. *curtaria.*
Hindwings with hindmargin not dentate 24. *cognata.*

23. Forehead ferruginous-ochreous............ 24.
Forehead fuscous or pale fuscous.......... 25.

24. Antennæ of ♂ with apical sixth simple.. 29. *excursaria.*
Antennæ of ♂ with apical tenth simple.. 30. *aganopa.*

25. Forewings with median shade strongly marked.................................... 17. *suasaria.*
Forewings with median shade almost obsolete.......... .... 32. *pallidiscaria.*

26. Lower half of face white..... .... 19. *externaria.*
Lower half of face not white............... 27.

27. Forewings with dark shade beyond second line running to hindmargin beneath apex .... 28. *luxaria.*
Forewings with dark shade not running to hindmargin.............................. 28.

28. Forewings grey-whitish...................... 36. *perfectaria.*
Forewings ochreous........................... 29.

29. Hindwings with second line almost straight........................ . ... 27. *agoraea.*
Hindwings with second line distinctly curved.................. .... 16. *thermaea.*

12. *Sel. silicaria*, Gn.

(*Hemerophila silicaria*, Gn. IX, 220; *H. mundifera*, Walk. 322; *Boarmia disrupta*, ib. 391; *Hemerophila excursaria*, ib. 1532.)

♂♀. 30-35 mm. Face dark fuscous, forehead and lower margin whitish. Antennal pectinations of ♂ 7, apical $\frac{1}{3}$ simple. Forewings with hindmargin obliquely bowed; vein 11 out of 10, anastomosing with 12; pale brownish-ochreous, finely irrorated with whitish, and with a few dark fuscous scales; lines slender, blackish-fuscous, sinuate, becoming obsolete towards costa, first nearly preceded and second nearly followed by rather dark ochreous-brown parallel shades; a black discal dot before median

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vein 11 out of 10, anastomosing with 12; whitish-ochreous, greyish-tinged, towards base and costa more brownish, thinly sprinkled with blackish; first line blackish, irregular, interrupted, subdentate; median shade nearly straight, black, posteriorly suffused with brownish; a black discal dot; second line ochreous-whitish, unevenly and interruptedly margined with dark fuscous, especially towards disc posteriorly, subdentate, irregular, twice sinuate, lower sinuation stronger and subangulated; space between second and subterminal lines brownish on upper half; subterminal hardly pale, partially blackish-margined, triangularly dilated at apex, dentate; a hindmarginal row of black dots. Hindwings with hindmargin rounded, waved; colour and hindmarginal dots as in forewings; median shade and margins of second and subterminal lines straight, waved, dark fuscous, becoming obsolete above; a black discal dot touching anterior margin of second line.

Melbourne, Victoria; three specimens (*Coll.* Lucas). Recognisable amongst similar species by the peculiar form of the second line of the forewings. *Tephrosia bispinaria*, Gn. IX, 266, which I have not succeeded in identifying, should apparently have this line nearly similarly formed, and it is just possible that it may be synonymous, but the description agrees very ill in other particulars; it may be a species unknown to me.

14. *Sel. amphiclina*, n.sp.

♂. 32 mm. Head and thorax unicolorous ochreous. Antennal pectinations 7, apical $\frac{1}{5}$ simple. Forewings with hindmargin obliquely bowed; vein 11 absent; pale yellowish-ochreous, with scattered grey strigulæ and a few black scales; first line indicated by blackish strigulæ but very indistinct, slightly curved, margined posteriorly by a deeper yellow-ochreous shade; a black discal dot; median shade obsolete; second line faintly paler, hardly traceable, except where margined posteriorly with blackish from vein 3 to 6, where it is slightly sinuate, but apparently with a biangulated projection below this; subterminal very faintly whitish, connected with hindmargin beneath apex by an ill-marked dark fuscous oblique streak; three blackish dots on upper half

of hindmargin: cilia whitish-ochreous. Hindwings with hindmargin rounded, unevenly waved; colour and strigulæ as in forewings, but basal half more whitish-ochreous; a dark grey discal dot; median shade forming a short grey line from inner margin; second line faintly traceable as a pale sinuate shade.

Sydney, New South Wales; in October, two specimens. Easily known by the yellowish-ochreous colouring, obsolescence of lines, and unicolorous head and thorax.

15. *Sel. eremias*, n.sp.

♂. 28 mm. Head and thorax pale brownish-ochreous, face moderately tufted, thorax with two posterior black dots. Antennal pectinations 8, apical $\frac{1}{6}$ simple. Forewings with hindmargin obliquely bowed; vein 10 connected with 12 and 9, 11 rising out of 10 between the bars; pale brownish-ochreous, with a few scattered black scales; first and second lines and median shade indistinctly traceable as sinuate series of blackish dots; two cloudy blackish spots towards hindmargin above and below middle,

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followed by an indistinct dark ochreous-brown shade; space between first and second lines brownish-grey; median shade thick, cloudy, irregular, dark brown, tolerably parallel to second line; subterminal ochreous-whitish, very indistinct, dentate, preceded on costa by a dark fuscous spot; a dark fuscous blotch on hindmargin beneath apex; an interrupted dark fuscous hindmarginal line. Hindwings with hindmargin rounded, dentate; colour and markings as in forewings, but first line almost basal, median shade almost obsolete, angulation of second line more rounded.

Newcastle, New South Wales; one specimen *(Australian Museum).* Differs markedly from its allies by its deep ochreous-brown colouring, and the contrasted median band.

17. *Sel. suasaria*, Gn.

(Boarmia suasaria, Gn. IX, 243 *(teste* Moore); *B. proposita*, Walk. 390; *Tephrosia gratularia*, ib. 415; *T. propinquaria*, ib. 415.)

♂♀. 29-34 mm. Face blackish, forehead and lower margin pale fuscous. Palpi with long rough hairs. Antennal pectinations in ♂ 8, apical $\frac{1}{6}$ simple. Forewings with hindmargin bowed; vein 10 anastomosing with 12, 11 absent; light fuscous, closely irrorated with dark fuscous and whitish; lines evenly curved, blackish-fuscous, interrupted to form dots in disc, second edged with paler posteriorly, sinuate inwards on submedian fold; median shade curved, thick, blackish-fuscous, strongest on lower half, sinuate outwards above and below middle; a light ochreous suffusion on submedian fold before first and beyond second line; subterminal line very indistinct, slender, dentate; an interrupted dark fuscous hindmarginal line. Hindwings with hindmargin rounded, slightly waved; colour and markings as in forewings, but first line absent, median shade straight, second line followed by a paler suffusion.

Brisbane, Queensland; Newcastle, New South Wales; said also to be from Albany, West Australia; four specimens. Characterised by the fuscous colouring, absence of white markings, strongly marked median shade, and wholly blackish face.

18. *Sel. curtaria*, Walk.

(*Tephrosia curtaria*, Walk. Suppl. 1592.)

♂. 22 mm. Face blackish (?). Antennal pectinations about 7, apical $\frac{1}{15}$ filiform. Forewings with hindmargin obliquely rounded, waved; whitish-fuscous, sprinkled with blackish; first and second lines curved, blackish, somewhat interrupted; median shade cloudy, hardly curved, blackish, connected by a slender bar with a cloudy blackish spot before second line in middle; subterminal cloudy, subdentate, whitish, anteriorly margined obscurely with blackish. Hindwings with hindmargin rounded, dentate; colour and markings as in forewings, but first line absent, a blackish discal dot beyond median shade, no spot or connecting bar before second line.

Queensland (Walker's citation of the locality as "Swan River" is erroneous, as I have shown elsewhere); one specimen in the British Museum, from which the above description is taken. The characters are incomplete, but the species appears to be a

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on upper half and towards inner margin; a thick oblique blackish-fuscous suffused streak from hindmargin below apex to middle of second line; an interrupted blackish hindmarginal line. Hindwings with hindmargin rounded, dentate; colour and markings as in forewings, but first line absent, median shade straight, second line not angulated.

Duaringa, Queensland; three specimens received from Mr. G. Barnard. A strongly marked insect, very distinct by the face half black and half white, and the peculiar angulated median shade, but otherwise closely resembling some forms of *S. canescaria.*

20. *Sel. canescaria*, Gn.

(*Boarmia canescaria*, Gn. IX, 249.)

♂. 31-32 mm. Face blackish, forehead white. Antennal pectinations 9, apical $\frac{1}{8}$ simple. Forewings with hindmargin waved, rounded; vein 10 connected or anastomosing with 12, 11 out of 10; light fuscous, sprinkled with dark fuscous, and more or less suffusedly irrorated with white; first line slender, dark fuscous, very acutely angulated near costa; a small black transverse discal mark, sometimes obsolete, before median shade; median shade slender, blackish-fuscous, angulated first inwards and then outwards beneath costa, on lower half often wholly suffused with second line; second line slender, slightly irregular, blackish-fuscous, sending a long very acute dentation inwards below costa, angulated outwards beneath this; subterminal whitish or white, often conspicuous and rather thick, margined anteriorly throughout with blackish-fuscous, connected with hindmargin beneath apex by a short blackish-fuscous suffused streak; a blackish hindmarginal line. Hindwings with hindmargin rounded, dentate; colour and markings as in forewings, but first line absent, median shade thicker, straight, second line nearly straight or slightly sinuate.

Duaringa, Queensland; Mount Lofty, South Australia; received commonly from Mr. G. Barnard and Mr. E. Guest. Readily known from the other species with black face by the strongly

marked lines, sharply angulated beneath costa, and in particular by the long acute subcostal dentation of the second line.

21. *Sel. lyciaria*, Gn.

(*Boarmia lyciaria*, Gn. IX, 250; *B. poecilaria*, ib. 250, pl. vi, 1; *B. semitata*, Walk. 389.)

♂♀. 52-55 mm. Face blackish, forehead whitish. Antennal pectinations 9, apical $\frac{1}{8}$ simple. Forewings with hindmargin strongly waved, rounded; vein 10 connected with 12, 11 out of 10; whitish-ochreous, densely strewn with fuscous strigulæ, and with scattered black scales; first line curved, rather dark fuscous; median shade slender, blackish-fuscous, curved, irregularly dentate and sinuate, angulated outwards above middle; second line blackish-fuscous, slightly irregular, twice dentate inwards beneath costa, angulated outwards beneath this, nearly followed except towards costa by a rather dark brown shade; subterminal slender, dentate, whitish, anteriorly margined with blackish-fuscous, forming a well marked subtriangular unmargined white spot in

[redacted]

Forewings with hindmargin rounded ; vein 10 connected or anastomosing with 12 and 9, 11 absent ; light grey, irrorated with black and sometimes partially mixed with whitish, sometimes ochreous-tinged, especially on veins ; first line black, curved, indented below middle ; median shade cloudy, blackish, nearly straight, slightly angulated in middle ; a black transverse-linear discal mark much beyond this ; second line somewhat irregular, black, angulated above middle ; subterminal hardly paler but sharply margined with black anteriorly, irregular, subdentate, approximated to second line beneath angle, where it is followed by an indistinct somewhat paler suffused patch ; a black hindmarginal line. Hindwings with hindmargin rounded ; grey-whitish ; median shade and second line grey, very faint, nearly straight ; a faint grey discal dot between these ; a cloudy grey hindmarginal band, its anterior edge more strongly marked towards lower extremity.

Melbourne, Victoria ; three specimens taken by Dr. Lucas, to whom I am indebted for a type. I have a specimen from Duaringa, Queensland, received from Mr. Barnard, which appears to be very closely allied but probably distinct ; I do not venture to describe it at present. This species and the following are distinguished from the rest by their small size, blackish heads, thoracic crest, and whitish hindwings contrasting with dark forewings ; the present species differs from the next in having all the lines well-marked, the second angulated, and the simple apical portion of the antennæ longer.

23. *Sel. capnota*, n.sp.

♂. 26 mm. Head and thorax blackish, thorax with well-developed posterior crest. Antennal pectinations 6, apical $\frac{1}{5}$ simple. Forewings with hindmargin somewhat bowed ; vein 10 connected with 9, 11 out of 10 ; ochreous-whitish, densely and suffusedly irrorated with black throughout, so as to appear wholly blackish, except a large round clear spot adjoining second line above middle, and second line itself, which is slender, hardly curved, with three or four slight dentations. Hindwings with

hindmargin rounded, somewhat uneven; whitish; inner margin narrowly suffused with blackish; median shade very faint, cloudy, grey; a grey discal dot; second line slender, grey, very indistinct; a cloudy fuscous-grey irregular subterminal shade; an interrupted fuscous hindmarginal line.

Albany, West Australia; in October, one specimen amongst *Leptospermum* in a swamp. Easily separated from the preceding by the general black suffusion obliterating most of the markings of the forewings, and the clear white posterior patch; the neuration is also different, but would perhaps not be constant.

24. *Sel. cognata*, Walk.

(*Boarmia cognata*, Walk. 392.)

♂♀. 24-27 mm. Face blackish, forehead grey-whitish. Antennal pectinations of ♂ 8, of ♀ 6, apical $\frac{1}{5}$ simple. Forewings with hindmargin obliquely bowed; 10 sometimes connected with 12 and 9, 11 absent; pale ochreous-grey, densely irrorated with whitish; first and second lines and median shade fine, fuscous-

in ♂ 8, in ♀ 3, apical $\frac{1}{10}$ simple. Abdomen with a black subapical ring on each segment. Forewings with hindmargin obliquely rounded; 10 sometimes connected with 9, 11 absent; fuscous, densely irrorated with grey-whitish and with scattered black scales; first line only visible on lower half, fine, black, straight, very oblique; a dark grey discal dot, sometimes obsolete; median shade fine, indistinct, dark fuscous with a few black scales, indistinctly acutely dentate and angulated near costa, touching extremity of first line in middle; second line represented by two black dots near costa, and a somewhat sinuate black line running from hindmargin below apex to $\frac{2}{5}$ of inner margin, nearly followed by a parallel obscure fuscous shade; subterminal obscurely paler, darker-margined, cloudy, dentate; a fine black hindmarginal line. Hindwings with hindmargin slightly rounded, rather strongly waved; colour, subterminal, and hindmarginal lines as in forewings; median shade slender, dark fuscous, slightly curved; a dark grey discal dot beyond this; second line slender, black, nearly straight, slightly bent near costa, nearly followed by a parallel fuscous shade.

Port Lincoln, South Australia; Fremantle, West Australia; in October, four specimens. Distinguished from the other species with grey colouring and blackish face by the peculiar disposition of the slender black first and second lines; the antennæ of the ♀ are pectinated as in *S. cognata*, but less strongly.

26. *Sel. leucoplecta*, n.sp.

♂. 25-27 mm. Face grey mixed with white. Forewings with hindmargin obliquely rounded; 10 anastomosing with 9, 11 absent; white, towards base and costa sprinkled with dark fuscous; first line cloudy, blackish, angulated above middle; median shade cloudy, fuscous, twice indented outwards; second line slender, black, forming an abrupt rounded projection posteriorly at $\frac{1}{3}$, and an obtuse angulation at $\frac{2}{3}$; posterior area beyond second line wholly fuscous, except subterminal line, which forms a narrow white fascia from apex to anal angle, suffusedly bordered with

darker; a dark fuscous hindmarginal line. Hindwings with hindmargin rounded, slightly waved; white, sprinkled with grey towards base; a small dark fuscous spot on middle of inner margin; a grey discal dot; second line dark fuscous, slightly waved, somewhat angulated above middle; posterior area beyond this wholly light fuscous-grey, except subterminal line, which forms a narrow white somewhat angulated anteriorly dark-margined fascia from apex to anal angle.

Melbourne, Victoria; two specimens (*Coll.* Lucas). Distinct by the white groundcolour and form of second line.

27. *Sel. agoraea*, n.sp.

♂♀. 31-33 mm. Face brownish, mixed with dark fuscous and whitish-ochreous. Forewings with hindmargin obliquely rounded, strongly waved; 11 rising out of 10; pale whitish-ochreous, irrorated with ochreous and dark fuscous, sometimes suffused almost wholly with brownish, especially posteriorly; first line [redacted]

28. *Sel. luxaria*, Gn.

(*Hemerophila luxaria*, Gn. IX, 220; *Tephrosia disperdita*, Walk. 416.)

♂. 34-35 mm. Face blackish-fuscous, lower margin and a bar above middle whitish-ochreous. Antennal pectinations 6, apical ⅕ simple. Thorax pale brownish-ochreous, with a strong black anterior bar. Forewings with hindmargin obliquely rounded, waved; 10 connected with 9, 11 rising out of 10; pale brownish-ochreous, with scattered black scales; a blackish line beneath costa from base to about ¼; first line and median shade fine, blackish-fuscous, very oblique, becoming obsolete towards costa; a black discal dot between these; second line represented by a black twice sinuate line running from hindmargin beneath apex to ⅓ of inner margin, preceded by a broad suffused whitish irroration, and nearly followed by a dark fuscous shade; a short irregular blackish-fuscous very oblique line from costa before apex; subterminal whitish, partially dark-margined, dentate, obsolete towards costa; a hindmarginal row of black dots or interrupted line. Hindwings with hindmargin gently rounded, unevenly dentate; colour and hindmarginal line as in forewings; median shade straight, slender, dark fuscous; a black discal dot; second line somewhat irregularly sinuate, black, nearly followed by a parallel dark fuscous shade; subterminal whitish, rather irregular, margined with blackish-fuscous.

Sydney, New South Wales; from September to November, rather common. Easily known from the other ochreous species by the characteristic form of the second line, and the blackish basal subcostal line. I may mention that Guénée's *hemipteraria*, which some have referred to this species, is in my opinion a New Zealand species of a different group (vid. Trans. N. Zeal. Inst. 1887, 60).

29. *Sel. excursaria*, Gn.

(*Tephrosia excursaria*, Gn. IX, 267; *T. exportaria*, ib. 268; *T. phibalapteraria*, ib. 268; *Hemerophila vestita*, Walk. 322; *Boarmia attributa*, ib. 390; *B. decertaria*, ib. 391.)

♂♀. 34-40 mm. Face blackish-fuscous, lower margin and forehead ferruginous-ochreous. Antennal pectinations of ♂ 4, apical ¼ simple. Forewings with hindmargin obliquely rounded, waved; 11 rising out of 10; varying from ochreous to fuscous, more or less irrorated with dark fuscous and sometimes with whitish; first line slender, curved, dark fuscous, marked with black on veins, sometimes thick and blackish-fuscous on lower half, preceded by a deeper ochreous shade; median shade slender, irregular, dark fuscous, ill-marked, angulated above middle, sometimes preceded by a blackish discal dot; second line black, usually slender, but sometimes thickened on lower ⅔, costal third usually reduced to three black dots, acutely angulated above middle and with a rounded-triangular prominence below middle, nearly followed by an ochreous-brown parallel shade, tending to be continued to hindmargin beneath apex; subterminal obscurely paler, partially darker-margined, slender, dentate; a hindmarginal black line or series of dots. Hindwings with hindmargin rounded, dentate, colour, subterminal, and hindmarginal lines as in fore-

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with some scattered black scales, in ♀ with some white irroration in disc; first and second lines represented by series of black dots, partially connected by extremely fine dark fuscous lines, first curved, nearly preceded by a deep ochreous parallel shade, second sinuate, forming a rounded-angular projection above middle and another below middle, nearly followed by a deeper ochreous or ochreous-brown shade on lower $\frac{2}{3}$, which forms a small suffused darker spot in middle, preceded by a stronger black mark on second line, and tends to be continued to hindmargin beneath apex; median shade slender, deeper ochreous or ochreous-brown, rather irregular, somewhat angulated above middle; subterminal obscurely paler, somewhat darker-margined, dentate; a hindmarginal row of black dots. Hindwings with hindmargin gently rounded, dentate; colour and subterminal line as in forewings; median shade ochreous, nearly straight; a blackish discal dot; second line slender, dark fuscous marked with black dots, slightly sinuate, nearly followed by an ochreous or ochreous-brown shade; a very fine blackish hindmarginal line.

Albany, West Australia; in December, five specimens. Allied to the preceding, but structurally distinct by the much shorter simple portion of the antennæ in ♂, and also distinguishable by the dotted lines and dark median spot beyond second line of forewings, and more ferruginous face.

31. *Sel. adelphodes*, n.sp.

♂♀. 29-30 mm. Face ochreous-white, with a few blackish scales. Antennal pectinations of ♂ 6, apical $\frac{1}{10}$ simple. Forewings with hindmargin rounded, strongly waved; 10 connected with 9, 11 rising out of 10; light fuscous, partially tinged with ochreous on veins, and irrorated with black, disc greyer and sprinkled with whitish; first and second lines and median shade very indistinctly marked, slender, darker fuscous, rather sinuate and obtusely angulated near costa, second line forming a more conspicuous dark fuscous mark in middle, and nearly followed on lower $\frac{2}{3}$ by an obscure darker shade irregularly continued to hindmargin beneath apex; a dark fuscous discal dot; subterminal

obscurely paler, dentate, partially darker-margined; a hindmarginal row of dark fuscous dots. Hindwings with hindmargin rounded, dentate; colour, subterminal line, and hindmarginal dots as in forewings; median shade cloudy, fuscous, nearly straight; a dark fuscous discal dot; second line hardly sinuate, fuscous, dotted with darker, nearly followed by an obscure fuscous parallel shade.

Albany, West Australia; in September, two specimens. Nearly allied to *S. aganopa*, but immediately separable by the ochreous-white face; it is also duller and more indistinctly marked, with the lines not dotted.

32. *Sel. pallidiscaria*, Walk.

(*Aspilates pallidiscaria*, Walk. 1683.)

♂. 28 mm. Head fuscous, face rather dark fuscous, lower margin white. Antennal pectinations 8, apical $\frac{1}{6}$ simple. Forewings with hindmargin obliquely rounded, waved; 10 connected with 9, 11 rising out of 10; rather light purplish-fuscous, basal [illegible]

markings indistinct; discal mark of hindwings (apparently lunular) touching median line.

Said to be from South Australia; one specimen in the British Museum, from which the above notes are taken; it is a very obscure insect, and not in fit condition to be worth describing, yet it does not seem identifiable with any other species, and claims some notice.

34. *Sel. destinataria*, Gn.

(*Gnophos destinataria*, Gn. IX, 297; *Boarmia attenta*, Walk. 393; *Tephrosia indirecta*, ib. 418; *T. vagaria*, ib. 1542.)

♂. 29-33 mm. Head pale ochreous, face irrorated with fuscous. Antennal pectinations 7, apical $\frac{1}{10}$ simple. Forewings with hindmargin rounded, strongly waved; 10 connected with 9, 11 out of 10; light yellowish-ochreous, irrorated with grey and a few blackish-grey and whitish scales; veins partially suffused with bright ferruginous-ochreous; first and second lines and median shade indistinct, ferruginous-ochreous, dotted with black on veins, rather irregular, forming small rather dark grey spots on costa; a blackish discal dot; subterminal forming a series of disconnected whitish marks; a hindmarginal series of black dots. Hindwings with hindmargin rounded, dentate; colour and markings as in forewings, but first line absent.

Blackheath (3500 feet), New South Wales; occurs also in Tasmania; in September, three specimens. A distinct species, easily known by the mottled yellowish-grey appearance, ferruginous veins, and dotted lines.

35. *Sel. zascia*, n.sp.

♂♀. 31-32 mm. Head blackish, with a few whitish scales. Antennal pectinations of ♂ 6, apical $\frac{1}{6}$ simple. Thorax blackish, irrorated with whitish, with three black bars. Abdomen white, sprinkled with black, two basal segments barred with black. Forewings with hindmargin bowed, waved; 10 connected with 9, 11 rising out of 10; grey, densely irrorated with black and white; first line and median shade blackish-grey, bent near

costa, somewhat curved; a large black discal dot immediately preceding median shade; second line blackish-grey, marked with black on veins, bent above middle, slightly sinuate below middle, nearly followed by a strong blackish-grey parallel shade, connected with hindmargin below apex by an ill-defined blackish-grey oblique streak; subterminal white, margined with blackish-grey, dentate, interrupted above and sometimes below middle; a hindmarginal row of large black dots, connected by a fine line. Hindwings with hindmargin rounded, dentate; colour and markings as in forewings, but first line absent, median shade straight and indistinctly marked, discal black dot considerably beyond it.

Melbourne, Victoria; a pair taken by Dr. Lucas and Mr. G. H. Raynor. Very distinct by the dense black and white irroration, and the almost wholly black head.

37. *Sel. perfectaria*, Walk.

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37. *Sel. euboliaria*, Walk.

(*Tephrosia euboliaria*, Walk. 419 ; *Scotosia fractata*, ib. 1359.)

♂♀. 26-28 mm. Head pale ochreous, with a ferruginous-blackish bar across forehead, and lower part of face sprinkled with blackish. Antennal pectinations of ♂ 5, apical $\frac{1}{6}$ simple. Thorax with a small double posterior crest. Forewings with hindmargin rounded, waved; 10 sometimes connected with 9, 11 separate; whitish-ochreous, tinged with brownish along costa, with a few scattered black scales, in ♀ tinged with fuscous-grey throughout; basal area more or less wholly brownish-ochreous; first line slender, slightly curved, ochreous-brown or blackish, sometimes nearly preceded by a parallel blackish shade; median shade rather strong, slightly curved, ochreous-brown or usually blackish, anteriorly sharply marked, posteriorly suffused with ochreous-brown; a black discal dot beyond this; second line fine, black or ochreous-brown, moderately curved, slightly sinuate inwards in middle, nearly followed by a more or less marked parallel dark ochreous-brown shade; subterminal obscure, ochreous-whitish, subdentate, closely approximated to preceding shade in middle, more or less margined with dark fuscous, and connected with an oblique angularly bent blackish-fuscous or ochreous-brown streak from hindmargin beneath apex; a hindmarginal row of black dots. Hindwings with hindmargin rounded, waved; colour and markings as in forewings, but paler whitish-ochreous towards base, first line and preceding shade absent, median shade straight, obsolete towards costa, second line nearly straight, slightly sinuate, subterminal not approximated to preceding shade.

Geraldton, West Australia; in November, common. A peculiar species, combining the antennal characters of the first group with the neuration of the second.

38. *Sel. argoplaca*, n.sp.

♂. 34-36 mm. Head whitish mixed with fuscous and dark fuscous, face blackish-fuscous. Antennal pectinations 5, apical $\frac{2}{5}$ simple. Thorax with short broad posterior crest. Forewings

with hindmargin slightly rounded, somewhat waved; 10 sometimes connected with 9, 11 separate; grey, partially tinged with ochreous, irrorated with white, and with numerous rather long dark fuscous strigulæ marked with black scales; a white spot at base of inner margin; first line blackish-fuscous, somewhat curved, indented below middle; median shade broad, suffused, blackish-fuscous, straight; a black transverse discal spot much beyond this, sometimes little marked, sometimes conspicuous; second line blackish-fuscous, partially interrupted, evenly and rather strongly edged with whitish posteriorly, curved outwards on upper half, sinuate inwards on lower half, followed by an ochreous shade; subterminal obscurely paler or sometimes white, irregular, subdentate, margined anteriorly with blackish and posteriorly with an ochreous-brown suffusion; a blackish suffusion before hindmargin above middle; a hindmarginal row of large black dots, connected by a fine line. Hindwings with hindmargin rounded, waved; white, bluish-tinged in disc; a blackish discal dot; a broad dark grey band along upper ⅔ of hindmargin, including a suffused white

indented below middle ; median shade rather thick, blackish, posteriorly rather broadly suffused with ochreous-brown, nearly straight, slightly indented in middle ; a small black discal dot close beyond this ; second line fuscous, indistinct except near inner margin where it becomes black, obtusely prominent above and below middle, tolerably nearly followed by an indistinct ochreous-fuscous parallel shade ; subterminal slender, whitish, partially obscure, irregular and subdentate, anteriorly strongly margined with black except towards inner margin, somewhat dilated with whitish-ochreous in middle, posteriorly margined with an ochreous or pale ferruginous suffusion ; a black hind-marginal line. Hindwings with hindmargin slightly rounded, dentate ; colour and markings as in forewings, but base and anterior half of costa suffused with ochreous-whitish, first line absent, second line sinuate, subterminal without pale dilation in middle.

Melbourne, Victoria ; Campbelltown, Tasmania ; in January, four specimens. From the three following species, which resemble it structurally, it is immediately known by the black discal dot of forewings.

40. *Sel. acaciaria*, Boisd.

(*Boarmia acaciaria*, Boisd., Faun. Mad. 116, pl. XVI, 4, Gn. IX, 255 ; *B. alienaria*, Walk. 370 ; *B. displicata*, ib. 389 ; *B. gelidaria*, ib. 1537.)

♂♀. 35-38 mm. Face with rather prominent tuft, whitish-grey, with broad blackish bar across lower part of face, and narrow more obscure bar on forehead. Antennæ in ♂ with apical $\frac{2}{5}$ simple. Forewings with hindmargin obliquely rounded, waved ; 10 sometimes connected with 9, 11 separate or sometimes connected with 10 ; grey, sometimes ochreous-tinged, densely irrorated with white, and with scattered black scales ; first line slender, black, dentate, roundly angulated near costa ; a transverse discal mark of raised whitish scales, suffusedly margined with grey, placed on and interrupting median shade, which is slender, blackish, curved, rather irregular ; second line well-marked, black, subdentate,

gently curved, nearly followed by a very indistinct grey parallel shade, and usually marked in middle with a small blackish spot or a short longitudinal line extending to hindmargin; subterminal whitish, very obscure, subdentate, grey-margined, forming a small dark spot on anterior edge above middle; a hindmarginal series of black dots, connected by a fine line. Hindwings with hindmargin gently rounded, dentate; colour and markings as in forewings, but first line absent, median shade stronger, nearly straight, second line more strongly marked on lower half, nearly followed by a more or less distinct brownish-ochreous parallel shade, without blackish spot in middle.

Newcastle, New South Wales; Geraldton, West Australia; in November, eight specimens. This and the two following species differ from the rest in the discal transverse spot of raised scales; *S. acaciaria* is smaller than the other two, and distinguishable from both by the well-marked black bar of face. This species occurs also in India, Ceylon, South Africa, and probably the adjoining islands; there is a tendency to the origination of slight

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fuscous or black on upper half, and sometimes emitting a streak anteriorly to touch discal spot; subterminal white, subdentate, margined with fuscous and partially with black, sometimes double for a short distance above middle, where it is surrounded by a blackish suffusion, beneath this forming a moderately large pale or white spot on hindmargin; a hindmarginal series of black marks. Hindwings with hindmargin rounded, dentate; colour and markings as in forewings, but median shade blacker, discal spot margined with black, second line sometimes obscured on lower $\frac{2}{3}$ by a very broad band of blackish suffusion, sometimes followed by a whitish suffusion, pale spot on middle of hindmargin little marked.

Brisbane, Queensland; three specimens (Dr. Lucas and Australian Museum). This species appears to be very variable in the extent and intensity of the blackish markings, and at present I cannot decide what points are most reliable for its characterisation, but the reddish-ochreous suffusion seems constant.

42. *Sel. epistictis*, Meyr.

(*Boarmia epistictis*, Meyr., Trans. Ent. Soc. Lond. 1889, 499.)

♂♀. 48-50 mm. Face ochreous-whitish, sometimes with a blackish lateral mark in middle. Antennal pectinations *a* 8, *b* 10, apical half filiform. Forewings with hindmargin gently rounded, in ♀ faintly waved; 10 and 11 separate; pale brownish-ochreous, with scattered blackish scales, more or less irrorated with white, in ♀ sometimes very densely; first line black, rather irregular, gently curved, nearly preceded by an ochreous-brown parallel shade, sometimes nearly obsolete; median shade ochreous-brown, obscure, somewhat irregular, nearly straight; an ill-defined transverse-oval dark grey discal spot, including a more or less marked ridge of somewhat raised whitish scales, sometimes hardly perceptible, adjointing posterior edge of median shade; second line black, subdentate, nearly straight, with a small sinuation outwards above middle, nearly followed by a very obscure ochreous-brownish shade; subterminal white, dentate, anteriorly margined by a small double blackish spot above middle, and posteriorly in

♀ by a darker suffusion between middle and apex; a hindmarginal row of round black dots, sometimes connected with two or three short black longitudinal streaks on veins. Hindwings with hindmargin rounded, waved; colour and markings as in forewings, but first line absent, median shade well-marked, more or less thick, blackish, discal spot more distinctly white, black-margined, second line curved outwards on upper $\frac{2}{3}$, often more strongly marked, subterminal without dark marginal suffusions above middle, but sometimes margined anteriorly with a blackish suffusion towards lower extremity.

Brisbane, Queensland; one specimen received from Dr. Lucas; also sent commonly from New Guinea. Differs from the two preceding by its large size, hindmargin of hindwings waved but not dentate, and longer simple portion of antennæ in ♂, as well as by its dull colouring, and reduction of frontal bar to a lateral mark.

9. Lophodes, Gn.

Face with tolerably appressed scales. Tongue developed. Palpi rather short, porrected, with projecting scales, terminal joint very short. Antennæ in ♂ very strongly bipectinated, apex simple. Thorax without crest, densely hairy beneath. Femora hairy beneath, posterior tibiæ in ♂ not dilated. Forewings in ♂ with small fovea; 11 separate or from a point with 10 (or probably sometimes stalked) or absent. Hindwings normal.

Includes only the following species, which is nearly related to the preceding genus.

43. *Loph. sinistraria*, Gn.

(*Lophodes sinistraria*, Gn. IX, 212, pl. x, 5.)

♂. 38-45 mm., ♀ 54-62 mm. Head and thorax blackish or partly deep ferruginous, anterior margin of thorax ochreous-whitish. Antennal pectinations of ♂ 18, apical $\frac{1}{10}$ simple. Forewings in ♀ elongate, hindmargin in ♂ somewhat rounded, waved, in ♀ more oblique, rounded-dentate, tooth on vein 5 nearly obsolete, so that there is a deep emargination between 4 and 6; rather deep ferruginous-ochreous, in ♀ sometimes towards costa and lower part of

hindmargin, in ♂ almost wholly suffused with dark fuscous, with scattered blackish scales; basal fourth of costa rather broadly in ♂ pale ochreous, in ♀ whitish, with scattered dark scales; first line black, curved, in ♂ twice, in ♀ once obtusely angulated, on lower half nearly preceded by a blackish shade; usually a pale patch on inner margin beyond this; median shade slender, usually very indistinct, dark fuscous or blackish, angulated near costa; second line slender, black, slightly irregular, curved and somewhat sinuate, followed on costa by a small ochreous-whitish or white spot; in ♀ sometimes a whitish shade beyond this; subterminal obscurely paler or nearly obsolete, in ♀ more whitish and dentate near costa, traversing a round pale spot of ground colour between veins 6 and 7, which in ♀ extends to hindmargin; a black interrupted hindmarginal line. Hindwings with hindmargin rounded, dentate; colour as in forewings, but lighter towards base; median shade, second, and subterminal lines as in forewings, but second line irregularly dentate, no pale subapical spot before hindmargin; a transverse black discal mark beyond median shade.

Newcastle and Sydney, New South Wales; Fernshaw, Victoria; in October, November, February, March, and May, locally common. It is a variable insect, and the sexes differ markedly. The larva feeds on *Acacia decurrens*.

10. Melanodes, Gn.

Face rough-scaled. Tongue developed. Palpi rather short, porrected, second joint with dense loose scales, terminal joint very short. Antennæ in ♂ subdentate, shortly ciliated. Thorax not crested, densely hairy beneath. Femora glabrous (?); posterior tibiæ in ♂ not dilated. Forewings in ♂ without fovea (?); 10 rising out of 9 below 7. Hindwings normal.

Contains the following species only; certainly a good genus, but although apparently sometimes common, I have not yet succeeded in obtaining good specimens for detailed examination, and the characters given above are in part uncertain. Hence the affinity of the species is also doubtful, but it seems allied to *Lophodes*.

44. *Mel. anthracitaria*, Gn.

(*Melanodes anthracitaria*, Gn. IX, 222, pl. IX, 7; *Praxis corvus*, Walk. Noct. 1087.)

♂♀. 45-55 mm. Forewings with hindmargin rounded, waved; blackish, the veins somewhat dotted with whitish; first and second lines black, first twice angulated outwards, second sinuate outwards in middle, followed on costa by a yellowish dot; median shade obscure, sinuate. Hindwings with colour and markings as in forewings, but first line absent, median and second straighter; a transverse black discal spot. Sometimes an ochreous-white suffusion forms a band beyond second line in both wings, and before first line in forewings.

Sydney, New South Wales; Fernshaw, Victoria; also in Tasmania (Austr. and Brit. Mus.). The above incomplete description is sufficient for identification.

11. Aporoctena, n.g.

Face with appressed scales. Tongue developed. Palpi short, porrected, rough-scaled, terminal joint very short. Antennæ in ♂ filiform, shortly ciliated. Thorax without crest, densely hairy beneath Femora glabrous; posterior tibiæ in ♂ dilated, containing tuft, tarsi extremely short. Forewings in ♂ with well-marked fovea; 10 rising out of 11, connected with 9. Hindwings normal.

Endemic; nearly related to *Selidosema*, differing only by the simple antennæ.

45. *Apor. scierodes*, n sp

♂. 26 mm. Head fuscous, crown whitish-ochreous behind, face with blackish median band, and mixed with whitish below this. Antennal ciliations ¼. Forewings with hindmargin rounded, slightly waved; ochreous-brown, strewn with numerous dark fuscous transverse strigulæ, space between first and second lines suffused with dark fuscous; lines blackish, somewhat irregular, placed near together, first curved, preceded by some whitish scales, median sinuate, second obtusely somewhat angulated above middle, sinuate inwards on lower half, edged with whitish posteriorly,

ground colour immediately beyond this somewhat mixed with whitish; subterminal very obscure, whitish, subdentate, suffused towards middle with dark grey, which forms a short oblique subapical streak; an interrupted black hindmarginal line. Hindwings with hindmargin rounded, somewhat waved; yellowish-ochreous, more whitish towards base and inner margin, strewn with dark fuscous scales or short strigulæ, apex suffused with dark grey; median shade blackish, somewhat bent in middle; second line rather thick, blackish, slightly sinuate, edged with whitish posteriorly; subterminal suffusedly edged with blackish anteriorly; an interrupted black hindmarginal line.

Brisbane, Queensland; one specimen received from Dr. Lucas. The yellowish tinge of the hindwings, though obscure, is a noticeable characteristic.

12. Hybernia, Latr.

Face tolerably smooth. Tongue short. Palpi moderate, porrected, rough-scaled, terminal joint short. Antennæ in ♂ moderately bipectinated throughout. Thorax not crested, slightly hairy beneath. Femora glabrous; posterior tibiæ in ♂ not dilated. ♀ semiapterous. Forewings in ♂ without fovea; 11 absent. Hindwings normal.

A small genus, occurring in the temperate regions of both hemispheres. The neuration quoted above is simply that of the Australian species; those of other regions display great variability in this character, but it is unnecessary to complicate the description of the genus by recording these variations here.

46. *Hyb. indocilis*, Walk.

(*Zermizinga indocilisaria* (!), Walk. 1530; *Hybernia boreophilaria*, Gn., Ent. Mo. Mag. V, 61; *H. indocilis*, Meyr., Trans. N.Z. Inst. 1883, 97.)

♂. 24-29 mm. Antennal pectinations *a* 6, *b* 7. Forewings with hindmargin gently rounded, waved; pale fuscous-grey, irrorated with dark fuscous; first line dark fuscous, curved, somewhat irregular; median shade cloudy, dark fuscous, slightly curved; second line dark fuscous or blackish, slightly curved, twice slightly

sinuate, sometimes nearly followed by an obscure ochreous shade; subterminal obscurely paler, subdentate, anteriorly margined by a darker fuscous shade; a hindmarginal series of blackish dots, connected by a fine line. Hindwings with hindmargin rounded, crenulate; colour and markings as in forewings, but first line absent, second line hardly sinuate; a transverse dark fuscous discal mark beyond median shade.

♀. 12-14 mm. Wings exceedingly narrow, apex suddenly dilated, angles acute, hindmargin dentate; colour and markings as in ♂, but lines blacker and more sharply marked.

Brisbane, Queensland; Sydney, New South Wales; Mount Lofty, South Australia; also occurs in New Zealand; from July to January, rather common, attached to *Leptospermum*.

13. Psilosticha, n.g.

Face with tolerably appressed scales. Tongue developed. Palpi short, porrected, rough-scaled, terminal joint very short. Antennæ [redacted]

subterminal pale, dentate, margined suffusedly with dark grey ; a fine black interrupted hindmarginal line, forming dots between veins. Hindwings with hindmargin rounded, waved; colour and markings as in forewings, but first line absent, median and second not or hardly curved, discal dot placed beyond median line.

Melbourne, Victoria; Georges Bay, Tasmania ; in December and January, two specimens.

14. Ectropis, Hb.

Face tolerably smooth or with hardly projecting scales. Tongue developed. Palpi moderate, porrected, rough-scaled, terminal joint short. Antennæ in ♂ biserrate-dentate, or bipectinated partially or throughout with two short slender (or rarely long) pectinations on each side of each joint, terminating in tufts of cilia. Thorax smooth or with slight crest, moderately or slightly hairy beneath. Femora glabrous; posterior tibiæ in ♂ moderately or slightly dilated, sometimes containing tuft. Forewings in ♂ with well-marked fovea; 10 sometimes anastomosing or connected with 12 and 9, 11 out of 10 between connections, sometimes running into 12 or absent. Hindwings normal.

The genus is comparatively small, but widely distributed, at least in temperate regions. The species included in it show considerable diversity of structure, but it seems unnecessary to subdivide the genus further, the differences being properly regarded as specific only; they agree in all essential points, and particularly in the possession of two teeth or pectinations on each side of each joint of the antennæ in the ♂, instead of one. In observing this point it must be remembered that there is a slight ridge of scales in the middle of each joint which might cause the impression that the joints are twice as numerous as they really are; this must be guarded against.

1. Antennæ in ♂ with moderate or long pectinations .... 2.
Antennæ in ♂ with very short pectinations or teeth.. 3.

2.	Forewings with a transverse discal mark ...	54. *camelaria.*
	Forewings with a discal dot only	51. *exsuperata.*
3.	Head fuscous	4.
	Head whitish or ochreous	5.
4.	Hindwings with hindmargin dentate.........	48. *pristis.*
	Hindwings with hindmargin waved	50. *isombra.*
5.	Face with a blackish median bar..............	6.
	Face unicolorous whitish-ochreous	49. *argalea.*
6.	Wings light grey; discal mark ringed	53. *fractaria.*
	Wings pale yellowish-ochreous; no discal ring	52. *subtinctaria.*

The antennal structure affords good distinguishing characters for each species.

48. *Ectr. pristis*, n.sp.

♂♀. 20-25 mm. Head and thorax fuscous-grey or dark fuscous, lower margin of face sometimes whitish. Antennæ in ♂ flatly dentate, with a moderate acute anterior tooth and a very minute

[redacted]

49. *Ectr. argalea*, n.sp.

♂. 19 mm. Head and thorax whitish-ochreous. Antennæ with two short slender pectinations (1) on each side of each joint, terminating in fascicles of cilia. Forewings with hindmargin gently rounded; 10 separate, 11 absent; pale ochreous, slightly brownish-tinged, with a few scattered black scales; usual lines faintly indicated by groups of black scales, but not distinctly traceable; a conspicuous black discal dot; a series of indistinct blackish marks on hindmargin. Hindwings with hindmargin rounded, unevenly waved; colour and markings as in forewings.

Sydney, New South Wales; in October and April, two specimens. The smallest species in the genus, differing from all the rest in the wholly whitish-ochreous head and thorax.

50. *Ectr. isombra*, n. sp.

♂♀. 23 mm. Head fuscous or whitish-fuscous, face sometimes with an indistinct darker bar. Antennæ in ♂ with two short acute teeth on each side of each joint, terminating in extremely long fascicles of cilia. Forewings with hindmargin gently rounded; 11 out of 10, running into 12; pale whitish-fuscous, irrorated with white and black; first line dark fuscous, very ill-defined, preceded by a cloudy brown shade; median shade slender, ill-defined, dark fuscous, irregular, rather strongly curved, preceded by a dark fuscous discal dot; second line blackish, tending to be interrupted or dotted, slightly curved, sinuate inwards near inner margin, nearly followed by an indistinct brownish shade; subterminal obscurely whitish, waved, more or less suffusedly margined with dark fuscous; a hindmarginal series of blackish dots. Hindwings with hindmargin rounded, waved; colour and markings as in forewings, but first line absent, median shade straight, followed by discal dot.

Duaringa and Brisbane, Queensland, in April; two specimens received from Mr. Barnard and Dr. Lucas. Differs in neuration from all the rest of the genus; an obscure-looking species, resembling *E. exsuperata* but smaller and duller, and the antennæ of the ♂ bear small teeth instead of well-developed pectinations as in that species.

51. *Ectr. exsuperata*, Walk.

(*Boarmia exsuperata*, Walk. 393; *Tephrosia disposita*, ib. 421.)

♂♀. 23-27 mm. Head whitish-ochreous or whitish, lower margin of face white surmounted by a narrow dark fuscous bar. Antennæ in ♂ with a closely approximated pair of moderate pectinations (3½) on each side of each joint, almost touching at base but diverging towards apex, apical ⅛ simple. Forewings with hindmargin rounded; 10 separate, 11 absent; pale brownish-ochreous, irrorated with whitish, and with scattered blackish scales; first line and median shade ill-marked, slender, dull reddish-ochreous, angulated near costa, first line partially marked with blackish; a blackish discal dot preceding median shade; second line slender, blackish, more or less interrupted or dotted, somewhat curved, rather sinuate inwards on lower third, nearly followed by a dull reddish-ochreous parallel shade; subterminal whitish, waved, suffusedly margined with dull reddish-ochreous, anterior margin partially dotted with blackish; a hindmarginal row of black dots. Hindwings with hindmargin rounded, waved; colour, second, and

[redacted]

few dark fuscous scales; first line slender, blackish, somewhat irregular, sharply angulated near costa; median shade slender, cloudy, dark fuscous, irregular, angulated above middle, dilated on costa, approximated to second line towards inner margin; second line blackish, indented beneath costa, forming a strong bidentate projection above middle, and a broader short obtusely bidentate projection below middle, concavity between these followed by a suffused fuscous or ochreous-brown spot; subterminal pale or whitish, slender, dentate, partially margined anteriorly and sometimes posteriorly by a dark fuscous suffusion; a hindmarginal row of black dots. Hindwings with hindmargin rounded, dentate; colour and markings as in forewings, but first line absent, median shade nearly straight or slightly bent in middle, somewhat irregular, second line tolerably evenly curved, without projection, sinuate near inner margin, followed by a parallel deeper ochreous shade throughout; a cloudy dark fuscous discal dot beyond median shade.

Newcastle and Sydney, New South Wales; in July and October, four specimens. From the other species with toothed antennæ it is at once separated by the large size and ochreous colouring; there is considerable superficial likeness to *Selidosema excursaria*, but apart from structural differences the colour and marking of the face appear to give a good distinction.

53. *Ectr. fractaria*, Gn.

(*Tephrosia fractaria*, Gn. IX, 270; *Hypochroma dissonata*, Walk. 443; *H. nigraria*, Feld. pl. CXXVI, 1.)

♂♀. 28-34 mm. Head grey-whitish, face with more or less broad blackish-grey median bar. Antennæ in ♂ with two short acute projections on each side of each joint, terminating in moderate fascicles of cilia. Forewings with hindmargin rounded, strongly waved; 10 sometimes connected with 9, 11 absent; light grey, irrorated and sometimes mixed with whitish, and densely irrorated with dark grey, often forming short strigulæ; lines dark fuscous, obscure, rather curved, first and second marked with blackish dots or wedges on veins, first line nearly preceded and

second followed by cloudy parallel dark fuscous shades; a short pale transverse discal mark before median shade, enclosed by a dark grey ring; subterminal whitish, dentate, partially margined anteriorly with dark fuscous spots; a hindmarginal row of blackish dots. Hindwings with hindmargin rounded, dentate; colour and markings as in forewings, but first line absent, median shade straight, more distinctly marked, preceding discal mark, second line followed by a more distinctly marked waved darker shade.

Sydney, New South Wales; Melbourne, Victoria; Launceston and Hobart, Tasmania; from September to March, rather common. From the other species with toothed antennæ in ♂ it is separable by the pale discal mark enclosed in a dark ring, as well as the grey colouring and moderate size.

54. *Ectr. camelaria*, Gn.

(*Boarmia camelaria*, Gn. IX, 256; *Cleora velutinaria*, Walk. Suppl. 1580.)

♂♀ 37-46 mm. Head whitish, face with a more or less distinct

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ill-defined, followed by a roundish dark fuscous discal spot, including a whitish transverse mark or cross.

Duaringa and Brisbane, Queensland; Newcastle, New South Wales; four specimens. Differs from all in the long pectinations and filiform apical $\frac{2}{3}$ of antennæ in ♂, and characterised also by the white groundcolour, ochreous irroration, and dotted lines.

15. Tigridoptera, HS.

Face with tolerably appressed scales. Tongue developed. Palpi moderate, ascending, shortly rough-scaled, terminal joint short. (Antennæ in ♂ probably ciliated.) Thorax not crested, glabrous beneath. Femora glabrous. Forewings (in ♂ probably with fovea); 10 rising out of 11, running into 9. Hindwings normal.

The characters of the ♂ are still unknown, and possibly they may present additional peculiarities. The genus is however distinct enough as it stands, and is most allied to the Palæarctic genus *Abraxas*.

1. Forewings with white markings .... 55. *mariana.*
   Forewings without white markings............ 2.
2. Wings with hindmarginal series of black marks.. 56. *matutinata.*
   Wings without hindmarginal black marks... 57. *rotundata.*

55. *Tigr. mariana*, White.

♀. 90-94 mm. Forewings black; a rather broad white fascia from $\frac{1}{3}$ of costa to $\frac{3}{5}$ of inner margin, lower extremity suddenly attenuated; a moderate white spot beneath costa at $\frac{2}{3}$, two smaller ones before hindmargin towards middle, and two very small ones towards apex. Hindwings black; a broad yellow fascia before middle, containing an irregular black spot above middle, suddenly attenuated above this and not reaching costa; two posterior curved series of moderate irregular yellow spots, second hindmarginal, middle spot of each confluent together into a single elongate spot.

Cape York, Queensland; two specimens (*Coll.* Macleay). I omitted to make a sufficient investigation of the characters of this species, but believe it is correctly referred to this genus.

56. *Tigr. matutinata*, Walk.

(*Panaethia matutinata*, Walk. 1109.)

♀. 58-62 mm. Head yellow-ochreous, face dark fuscous. Thorax light grey-blue, anterior margin blackish, shoulders with a yellow-ochreous spot. Abdomen ochreous-yellow. Forewings with hind-margin obliquely rounded; rather deep yellow-ochreous; entire disc light grey-blue, except a rather broad longitudinal streak from centre of disc outwards, and another along submedian fold; a small blackish spot near base below middle; six irregularly curved rather thick cloudy black lines, margined with light grey-blue on the yellow areas, first not reaching inner margin, second and third confluent on submedian fold, fourth and fifth interrupted to form small spots, fifth interrupted by the yellow longitudinal streaks,

[redacted]

band light dull yellow-ochreous; five rather thick cloudy curved black lines, second and third confluent on submedian fold, fifth interrupted by the ochreous longitudinal streaks; a series of cloudy oval black spots representing the sixth line, rather broadly interrupted in middle; a faint grey subapical spot before hindmargin, and another above anal angle. Hindwings with hindmargin rounded; colour and markings as in forewings, but first two lines absent, grey subapical and supra-anal spots absent.

Cardwell, Queensland; one specimen received from Mr. Raynor.

16. Lomographa, Hb.

Face nearly smooth. Tongue developed. Palpi short, porrected, rough-scaled, terminal joint very short. Antennæ in ♂ bipectinated, apex simple. Thorax not crested, slightly hairy beneath. Femora glabrous; posterior tibiæ in ♂ not dilated. Forewings in ♂ without fovea; 10 absent, 11 anastomosing or connected with 12 and 9. Hindwings normal.

There are several European species of this genus; probably it occurs in other regions, but is as yet insufficiently recognised. It is nearly allied to *Deilinia*, but differs in the absence of vein 10. In some European species vein 11 is not connected with 12, the same variation which occurs in *Deilinia*, and therefore not involving separation; I mention it, as this may occur in the Australian species also, though no instance has met my observation.

Head and thorax grey .... 58. *spodina*.
Head and thorax ochreous .... 59. *isocyma*.

58. *Lom. spodina*, n.sp.

♂. 20-24 mm. Head and thorax grey. Antennal pectinations 5, apical $\frac{1}{10}$ simple. Forewings with hindmargin somewhat bowed, waved; grey, sprinkled with blackish; first and second lines somewhat curved, waved, slightly darker, marked with blackish dots on veins; median shade very faintly darker; a blackish discal dot; subterminal slightly paler, obscurely edged with darker, anterior edge sometimes dotted with darker; a hindmarginal row of blackish dots. Hindwings with hindmargin

rounded, waved; colour and markings as in forewings, but first line absent, median shade more perceptible, second line distinctly darker.

Sydney, New South Wales; Mount Lofty, South Australia; in September, October, March, and April, rather common; an obscure species, and probably overlooked.

59. *Lom. isocyma*, n.sp.

♂♀. 22-23 mm. Head and thorax pale ochreous or brownish-ochreous. Antennal pectinations in ♂ 6, apical $\frac{1}{5}$ simple. Forewings with hindmargin rounded, hardly waved; pale ochreous, sprinkled with ochreous-whitish, and more or less suffusedly irrorated with deeper ochreous or fuscous; first line and median shade hardly traceable; a rather dark fuscous discal dot; second line fuscous, waved, slightly curved, margined posteriorly by a pale shade; subterminal pale, subdentate, margined with darker suffusions; no hindmarginal dots. Hindwings with hindmargin

2. Head with a clear white band behind antennæ	3.	
Head without white band behind antennæ...	4.	
3. Wings reddish-tinged	63.	*oenias.*
Wings not reddish-tinged.......................	66.	*ochthadia.*
4. Head irrorated with white	65.	*cremnias.*
Head not irrorated with white	5.	
5. Hindwings in ♂ densely hairy beneath towards base..................................	62.	*impressaria.*
Hindwings in ♂ not hairy	6.	
6. Antennæ in ♂ with apical $\frac{1}{12}$ simple.........	60.	*eccentritis.*
Antennæ in ♂ with apical $\frac{1}{6}$ simple	61.	*rectaria.*

60. *Deil. eccentritis*, n.sp.

♂♀. 28-30 mm. Head in ♂ ferruginous-fuscous, crown ochreous, in ♀ light fuscous, crown ochreous-whitish; face smooth, with very short slight tuft on lower edge. Antennal pectinations in ♂ 16, apical $\frac{1}{12}$ simple. Femora thinly hairy beneath. Forewings with hindmargin rounded, waved; 11 anastomosing with 12; light ochreous-brownish, more or less reddish-tinged, strewn with short dark grey transverse strigulæ; first and second lines and median shade dark grey, waved, somewhat curved, all very obscure and little traceable, in ♂ sometimes first line preceded and second followed by a broad clear reddish-ochreous suffusion; a moderately large blackish-grey discal dot, in ♂ ringed with grey-whitish scales or sometimes transformed into a small round white spot; subterminal represented by a series of obscure blackish dots, in ♂ followed by whitish scales or dots and preceded by a ferruginous suffusion, in ♀ followed by a moderately large double dark grey spot below middle; a hindmarginal row of black dots. Hindwings with hindmargin rounded, waved; colour and markings as in forewings, but first line obsolete and not preceded by reddish-ochreous suffusion.

Warragul, Victoria; taken commonly in December by Mr. G. H. Raynor, who gave me specimens. It is a remarkably variable species, but differs from all the rest by the hairy femora; the

pectinations of the antennæ in the ♂ are much longer, and the apical simple portion much shorter than in any other.

61. *Deil. rectaria*, Walk.

(*Casbia rectaria*, Walk. Suppl. 1667; *C. irrorata*, Butl., Trans. Ent. Soc. Lond. 1886, 438.)

♂♀. 23-27 mm. Head fuscous, crown paler; face shortly rough-scaled. Antennal pectinations in ♂ 10, apical $\frac{1}{6}$ simple. Femora glabrous. Forewings with hindmargin bowed; in ♂ with a small gland surrounded by an irregular depression on lower surface immediately beneath cell near base; 11 free; light ochreous-brownish, with fine scattered dark fuscous or blackish scales tending to form obscure strigulæ; costal edge more ochreous; first and second lines and median shade obsoletely darker, hardly traceable, median shade straight and more distinct on lower half; a black discal dot, two small variable spots or dots near beyond second line in middle and one midway between these and apex,

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median shade rather darker, nearly straight, but very faint and often hardly traceable ; a blackish discal dot ; sometimes two or three small adjacent ferruginous spots near beyond second line in middle, partially blackish-edged ; a hindmarginal row of black dots. Hindwings in ♂ clothed with dense hairs towards base beneath, hindmargin rounded ; colour and markings as in forewings, but first line absent.

Duaringa, Queensland; received commonly from Mr. G. Barnard. Differs from all the rest by the dense hairs on the undersurface of the hindwings in the ♂.

63. *Deil. oenias*, n.sp.

♂. 27 mm. Head reddish-ochreous, a band on vertex behind antennæ white; face smooth. Antennal pectinations in ♂ 10, apical $\frac{1}{8}$ simple. Femora glabrous. Forewings with hindmargin straight on upper half, rounded beneath ; 11 anastomosing with 12 ; pale reddish-ochreous, with fine scattered grey strigulæ and a few blackish scales ; costal edge more yellowish ; first line and median shade grey, straight ; a black discal dot on median shade; second line grey, sinuate, very indistinct, hardly traceable ; subterminal appearing as a grey-whitish dentate line on a patch below middle, edged anteriorly by a blackish suffusion preceded by a deep reddish suffusion, and posteriorly by a grey suffusion, elsewhere represented by a series of cloudy blackish-grey dots ; a hindmarginal series of black dots. Hindwings with hindmargin rounded, slightly waved ; colour and markings as in forewings, but first line absent, discal dot following median shade, second line straighter, markings representing subterminal line much reduced or partially obsolete.

Georges Bay, Tasmania ; in January, two specimens. The white band on the vertex of the reddish-ochreous head distinguishes it easily from the three preceding, to which it is otherwise nearly related.

64. *Deil. lithodora*, n.sp.

♂♀. 18-22 mm. Head ochreous-whitish, back of crown more ochreous, face shortly rough-haired, forming short tuft beneath.

Antennal pectinations in ♂ 8, apical $\frac{1}{3}$ simple. Femora glabrous. Forewings with hindmargin straight on upper half, rounded beneath; 11 anastomosing or connected with 12, rarely rising out of 9; pale greyish-ochreous, irrorated with whitish, with a few blackish scales; costal edge pale rosy-ochreous, strigulated with blackish; first line and median shade fuscous, bent near costa, sometimes very indistinct; a black discal dot before median shade; second line fuscous, upper half rather curved outwards, usually darker below middle; subterminal obscurely whitish or hardly paler, irregular, preceded by a series of light red spots, sometimes incomplete, partially blackish-margined, especially below middle, where the red is sometimes obscured with black and sometimes confluent with second line; a hindmarginal series of black dots. Hindwings with hindmargin rounded; colour and markings as in forewings, but first line absent, discal dot beyond median shade, median shade and second line straight, markings preceding subterminal line fainter or usually obsolete.

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Geraldton, West Australia; in October and November, common. Larger and more obscure than the preceding, without red spots, and with the hindwings greyer and more obsoletely marked.

66. *Deil. ochthadia*, n.sp.

♂♀. 22-24 mm. Head ochreous-brown; with a white band behind antennæ, face shortly tufted. Antennal pectinations in ♂ 10, apical $\frac{1}{6}$ simple. Thorax pale whitish-ochreous, more whitish anteriorly. Femora glabrous. Forewings with hindmargin straight on upper half, rounded beneath, slightly waved; 11 rising out of 9, anastomosing with 12; pale brownish-ochreous, with scattered grey or dark grey strigulæ; first line represented by two fuscous marks in disc; a blackish discal dot; second line dark fuscous, sinuate, obsolete towards costa or more or less throughout; subterminal cloudy, obscurely whitish, anteriorly margined rather thickly with fuscous or dark fuscous, not reaching costa; a more or less interrupted blackish hindmarginal line. Hindwings with hindmargin rounded, unevenly waved; colour and markings as in forewings, but lines almost wholly obsolete.

Mount Kosciusko (2700 feet), New South Wales; in January, locally common. Differs from the two preceding by the distinctly contrasted white band of the vertex; it is also the only species in which vein 11 appears to rise constantly out of 9, but this character would perhaps hardly be absolute.

18. SCARDAMIA, Gn.

Face with short conical scaled projection. Tongue developed. Palpi moderate, ascending, with tolerably appressed scales, terminal joint minute. Antennæ in ♂ bipectinated, apex simple. Thorax not crested, glabrous beneath. Abdomen shortly crested towards base. Femora glabrous; posterior tibiæ in ♂ not dilated. Forewings in ♂ without fovea; 11 rising out of 10, anastomosing with 12. Hindwings normal.

An Indo-Malayan and African genus of very few species.

67. *Scard. chrysolina*, n.sp.

♀. 26 mm. Head, thorax, and abdomen ochreous-orange; abdomen with a small golden-metallic fuscous crest near base. Forewings with hindmargin obliquely rounded; ochreous-orange; costal edge brownish; lines slender, pale golden-metallic, appearing purplish-fuscous from above; first line proceeding from base along costa, then beneath costa to $\frac{1}{3}$, thence abruptly bent and running in a gentle curve to inner margin before middle; a dark fuscous discal dot; second line gently curved, sinuate inwards towards inner margin; an interrupted hindmarginal line. Hindwings with hindmargin rounded; colour and markings as in forewings, but first line obsolete towards costa.

Newcastle, New South Wales; one specimen (Australian Museum).

19. Rhinodia, Gn.

Face with projecting tuft of scales. Tongue developed. Palpi long, porrected, rough-scaled, terminal joint moderate. Antennæ

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fuscous or dark fuscous, in ♀ with ferruginous, only distinct near costa, usually followed by a blackish dot in middle and another towards costa. Hindwings with hindmargin obtusely angulated in middle; colour and markings as in forewings, but first line absent, a blackish discal dot beyond median shade, second line sometimes well-marked throughout, somewhat waved, sometimes followed by a series of dark fuscous dots.

Duaringa, Queensland; Sydney, New South Wales; Melbourne and Fernshaw, Victoria; York, West Australia; in October and November, rather common.

20. PROBOLOPTERA, n.g.

Face smooth. Tongue developed. Palpi moderate, porrected, shortly rough-scaled, terminal joint moderate. Antennæ in ♂ bipectinated throughout. Thorax not crested, hairy beneath. Femora hairy beneath; posterior tibiæ in ♂ not dilated. Forewings in ♂ without fovea; 10 sometimes out of 9, connected or anastomosing with 9, 11 anastomosing with 12 and 10. Hindwings normal.

69. *Prob. embolias*, n.sp.

♂♀. 32-34 mm. Head white, face with a crimson median band, back of crown ochreous-fuscous tinged with crimson. Palpi ochreous mixed with crimson. Antennal pectinations in ♂ 8, in ♀ 2. Forewings elongate-triangular, hindmargin obliquely rounded, rather strongly waved, inner margin sinuate inwards posteriorly; light purplish-grey, mixed and partially suffused with ochreous-whitish, with scattered short dark grey strigulæ, and a few black scales, in ♀ wholly suffused with light purplish-ferruginous, becoming deeper along hindmargin; first line slender, dark fuscous, less distinct in disc, angulated and sometimes dentate above middle; a dark fuscous discal dot; median shade slender, dark fuscous mixed with red, only distinct towards extremities, slightly curved; an irregular pale cloudy transverse shade (representing second line) near beyond this, becoming whitish towards inner margin, where it is followed by a cloudy dark fuscous spot mixed with red. Hindwings with costa sinuate

anteriorly, strongly excised before apex, so that the apex forms a strong acute projecting tooth, hindmargin unevenly dentate, rather deeply excised between veins 4 and 6; colour and discal dot as in forewings; median shade straight, blackish mixed with red, well-marked, preceding discal dot; second line in ♂ indicated by two very faint slender waved whitish lines.

Blackheath (3500 feet), New South Wales; in November, four specimens. This striking species appears to be nearly allied to the Indian *clelia*, Cr., which is presumably congeneric, though I have not been able to examine its structure; the locality seems an unlikely one for an insect of such affinities.

21. Idiodes, Gn.

Face with projecting tuft of scales. Tongue developed. Palpi moderate, subascending, rough-scaled, terminal joint short. Antennæ in ♂ rather stout, filiform, minutely ciliated. Thorax not crested, densely hairy beneath. Femora hairy beneath; [redacted]

curved at costal extremity; a blackish discal dot; subterminal hardly perceptibly paler, dentate, sometimes margined anteriorly by a series of irregular blackish spots; a hindmarginal series of black dots. Hindwings with hindmargin rounded, waved; colour, second line, and hindmarginal dots as in forewings, but colour rather paler, second line almost or quite straight throughout.

Melbourne, Victoria; two specimens taken by Mr. Raynor. Perhaps this species may vary as much as the next, but it is easily distinguished from it by the slender thorax, somewhat longer antennal ciliations, slightly bent hindmargin of forewings, more strongly rounded hindmargin of hindwings, and less dilated tibiæ.

71. *Id. apicata*, Gn.

(*Idiodes apicata*, Gn. IX, 40; *I. mitigata*, ib. 40, pl. XIII, 1; *I. inspirata*, ib. 40, Feld. pl. CXXIV, 3; *I. rinata*. ib. 40; *I. introducta*, Walk. 30; *Tacparia zalissaria*, ib. 234; *Choara siculoides*, ib. 291; *Phallaria conductaria*, ib. 1525; *P. inductaria*, ib. 1526; *Idiodes punctiger*, Feld. pl. CXXIV, 4.)

♂♀. 37-44 mm. Antennal ciliations of ♂ $\frac{1}{6}$. Thorax stout. Posterior tibiæ in ♂ very strongly dilated. Forewings with apex acute, prominent, hindmargin strongly bowed; pale greyish-ochreous, brownish-ochreous, or light fuscous, strewn with more or less faint dark strigulæ, and a few blackish scales; costal edge sometimes white on anterior $\frac{2}{3}$; first line thick, cloudy, dark grey mixed with brown, curved and twice angulated, but almost always wholly absent or represented by two or three blackish dots only; a black discal dot; median shade usually absent, sometimes partially marked with dark fuscous or reddish-fuscous on lower half; second line rather dark fuscous or hardly perceptibly darker than groundcolour, sometimes marked with black dots on veins, almost straight, costal extremity usually obsolete, sometimes margined posteriorly by a whitish-ochreous or light reddish line, sometimes nearly followed by a parallel fuscous or dark fuscous shade continued to apex of wing; subterminal obsolete or indicated by cloudy blackish margins on a patch above middle and a spot at anal angle only, rarely on whole of lower half; a hindmarginal

[redacted]

series of small blackish dots. Hindwings with hindmargin slightly rounded; colour and markings as in forewings, but first line and discal dot wholly absent, second line not followed by dark parallel line, subterminal almost always obsolete.

Sydney and Bathurst (2300 feet), New South Wales; Melbourne, Victoria; Georges Bay, Tasmania; Mount Lofty, South Australia; from August to February, rather common generally. Certainly very variable, but it is equally certain that the varieties all belong to the same species, every intermediate form being found.

22. Metrocampa, Latr.

Face with slight projection of scales. Tongue developed. Palpi moderate, porrected, rough-scaled, terminal joint very short. Antennæ in ♂ bipectinated to apex, pectinations rather stout. Thorax not crested, somewhat hairy beneath. Femora glabrous; posterior tibiæ in ♂ dilated, containing tuft. Forewings in ♂

[redacted]

margin, sometimes indicated only by dark fuscous dots on veins, posteriorly margined by a pale line. Hindwings with hindmargin rounded, waved; pale reddish-ochreous, suffusedly finely irrorated with grey or blackish-grey, less strongly towards base, the irroration forming an obscure darker sometimes dotted line, followed by a pale line from costa before apex to inner margin at $\frac{2}{3}$, almost straight.

Melbourne, Victoria; four specimens (*Coll.* Lucas).

73. *Metr. ada*, Butl.

(*Gynopteryx ada*, Butl., Ann. Mag. Nat. Hist. 1882, 91.)

♂ 30-31 mm. Antennal pectinations 3. Forewings with hindmargin obtusely angulated in middle on vein 4, upper half slightly concave, lower half straight; light ochreous, with a few scattered black scales, and traces of fuscous strigulæ; first line fuscous, curved, somewhat angulated above and below middle; a grey discal dot ringed with blackish, sometimes with one or two central whitish scales; second line rather dark fuscous, posteriorly sometimes edged with an ochreous-whitish line, nearly straight or somewhat sinuate, reaching costa close before apex. Hindwings with hindmargin rounded, unevenly waved, somewhat projecting angularly in middle on vein 4; pale ochreous, slightly fuscous-tinged, more whitish towards costa; second line faintly paler, obscurely margined on both sides with grey, running from costa before apex to middle of inner margin, slightly sinuate.

Sydney and Bathurst (2300 feet), New South Wales; in April, three specimens.

23. Planolocha, n.g.

Face with projecting tuft of scales. Tongue developed. Palpi moderate, subascending, rough-scaled, terminal joint short. Antennæ in ♂ subdentate, shortly ciliated. Thorax not crested, somewhat hairy beneath. Abdomen in ♂ with dense tuft of hairs on each side beneath at base. Femora glabrous; posterior tibiæ in ♂ dilated, containing tuft. Forewings in ♂ without fovea; 10 connected with 9. Hindwings normal.

Contains only the following endemic species.

[redacted]

74. *Plan. autoptis*, n.sp.

♂. 31 mm. Antennal ciliations ¼. Abdomen with pairs of dark fuscous dots on back of four basal segments, basal tufts mixed with blackish. Tuft of posterior legs black. Forewings with costa somewhat sinuate, hindmargin very obtusely angulated in middle, upper half somewhat concave, lower faintly sinuate; whitish-fuscous, mixed with whitish-ochreous, with a few scattered dark fuscous scales; costa dotted with dark fuscous; first line faintly darker, with darker fuscous dots on veins, angulated above and below middle, indented in middle; a rather large roundish dark reddish-brown discal spot, sometimes split up by a cruciform mark of groundcolour; second line represented by a nearly straight series of small blackish dots on veins from costa before apex to inner margin at ⅔, partially preceded by reddish-brown dots or a faint suffusion, on inner margin terminating in a short streak. Hindwings with hindmargin rounded, unevenly waved; [redacted]

to denudation, so that it is a difficult character to observe; but it is important, and undoubtedly proves the close relationship of this genus to the *Chlenias* group.

1. Forewings with veins marked with black lines .... 83. *leucaniata*.
   Forewings with veins not marked with black lines .... 2.
2. Forewings more or less reddish or ferruginous .... 3.
   Forewings not reddish .... 5.
3. Hindwings dark grey .... 80. *milvaria*.
   Hindwings light grey .... 4.
4. Forewings with distinct lines; face strongly tufted .... 81. *catacris*.
   Forewings with lines obsolete; face hardly tufted .... 82. *arotraea*.
5. Forewings with hindmargin more or less bent in middle .... 6.
   Forewings with hindmargin rounded, not bent .... 8.
6. Forewings with large discal spot .... 77. *demistis*.
   Forewings with discal dot or none .... 7.
7. Forewings with first line twice angulated .... 79. *australis*.
   Forewings with first line once angulated .... 75. *goniota*.
8. Forewings with large discal spot .... 76. *sparsularia*.
   Forewings with obsolete dot .... 78. *amblopa*.

75. *Am. goniota*, n.sp.

♂. 24 mm. Face loosely scaled. Antennal pectinations 7. Forewings with hindmargin bowed, very obtusely angulated in middle on vein 4, upper half slightly concave; whitish-ochreous, with scattered fuscous and dark reddish-fuscous scales; lines slender, somewhat interrupted, dark reddish-brown; first rectangularly angulated slightly below middle; second waved,

somewhat irregular, slightly sinuate inwards above middle and more strongly outwards below middle; a faintly darker discal spot, almost obsolete; an incomplete hindmarginal series of dark fuscous dots. Hindwings with hindmargin rounded, slightly waved, almost bent in middle; very pale whitish-grey; a faint darker grey discal dot; second line grey, formed as in forewings, but very faint.

Mount Lofty, South Australia; one specimen received from Mr. E. Guest.

76. *Am. sparsularia*, Gn.

(*Panagra sparsularia*, Gn. X, 131, pl. XII, 4.)

♂. 28 mm. Face prominent, almost smooth. Antennal pectinations 6. Anterior tibiae with strong apical hook. Forewings with hindmargin gently rounded, slightly waved; pale fuscous, with faint darker strigulae, and some scattered black scales; a blackish dot towards base in middle; first line represented by [redacted]

blackish dots. Hindwings rounded, unevenly waved; whitish-grey, more or less tinged with whitish-ochreous towards base, indistinctly strigulated with darker grey; a small cloudy darker grey discal spot, sometimes almost obsolete.

Mount Lofty, South Australia; two specimens received from Mr. E. Guest.

78. *Am. amblopa*, n.sp.

♂. 31-33 mm. Face prominent, with projecting scales. Antennal pectinations 5. Forewings with apex slightly prominent, hindmargin bowed, waved; light greyish-ochreous, closely strigulated or irrorated with light fuscous; costal edge clear pale ochreous; lines cloudy, somewhat darker, marked with blackish dots on veins, first somewhat curved, second slightly curved; a fuscous discal dot, almost obsolete. Hindwings with hindmargin somewhat rounded, strongly waved; whitish-grey, closely strigulated with darker grey; a large cloudy grey discal spot, darkest in centre; second line indistinct, somewhat curved, grey, marked with more or less defined blackish dots on veins.

Bathurst, New South Wales; Mount Lofty, South Australia; three specimens received from Mrs. Stephenson and Mr. E. Guest.

79. *Am. australis*, Ros.

(*Odontoptera australis*, Ros., Ann. Mag. Nat. Hist. 1885, 428, pl. XI, 9.)

♂. 31 mm. Forewings with hindmargin rounded, little oblique, excavated between apex and vein 6, and less deeply between 6 and 4, beneath 4 waved; rather light fuscous, with a few scattered dark fuscous scales; first line slender, dark grey, ill-defined, broadly angulated outwards above and again below middle; a dark grey discal dot; second line slender, blackish, anteriorly shaded with grey, rather near and parallel to hindmargin throughout, but dentate on all veins. Hindwings with hindmargin rounded, waved; light fuscous-greyish; a faint slender darker waved line at $\frac{3}{4}$ parallel to hindmargin.

Melbourne, Victoria; one specimen (*Coll.* Lucas).

80. *Am. milvaria*, Gn.

(*Scodiona milvaria*, Gn. X, 140, pl. VIII, 8.)

♂. 28. Face rather protuberant. Antennal pectinations 4. Forewings with apex slightly produced, hindmargin rounded, slightly oblique; dull flesh-colour, near costa and hindmargin sprinkled with dark grey; costal edge bright ferruginous; lines marked by dark reddish-fuscous dots on veins, first slightly curved, second rather near hindmargin, sinuate outwards near costa; a roundish cloudy dark grey discal spot. Hindwings with hindmargin waved, rounded; rather dark grey, lighter on anterior half; a cloudy dark grey roundish discal spot; an obscure curved postmedian series of darker dots; cilia dull flesh-colour.

Mount Lofty, South Australia; one specimen bred in March (*Coll.* Guest). Larva 10-legged; dark brownish-green, with numerous fine wavy black lines; a dorsal series of broad orange [redacted]

82. *Am. arotraea*, n.sp.

♂. 29 mm. Face loosely scaled. Antennal pectinations 7. Forewings with apex slightly prominent, hindmargin rounded; reddish-fuscous, appearing indistinctly strigulated, veins suffused with yellow-ochreous; costa strigulated with darker reddish-fuscous and white; lines obsolete. Hindwings with hindmargin rounded, slightly waved; whitish-grey, towards hindmargin indistinctly strigulated with darker and somewhat purplish-tinged; cilia light reddish-fuscous.

Melbourne, Victoria; one specimen received from Mr. G. H. Raynor.

83. *Am. leucaniata*, Gn.

(*Liodes leucaniata*, Gn. X, 120, pl. XVIII, 3; *Chlenias vittuligera*, Walk. 1153.)

♂♀. 31-34 mm. Head whitish-yellow on crown, face light brownish-ochreous, with short projecting scales beneath. Antennal pectinations 7. Forewings with hindmargin rounded; light brown; veins marked with black lines, except those running to costa; interneural spaces between these lines marked each with a narrow white streak, terminating on hindmargin in a black dot. Hindwings with hindmargin rounded, slightly waved; pale brownish, somewhat darker posteriorly; posterior half marked with whitish-ochreous or whitish longitudinal streaks between veins.

Sydney, New South Wales; Mount Lofty, South Australia; three specimens received from Messrs. Guest and Raynor.

25. NERITODES, Gn.

Face smooth. Tongue developed. Palpi short, porrected, rough-scaled, terminal joint very short. Antennæ in ♂ subdentate, ciliated. Thorax not crested, glabrous beneath. Femora glabrous; posterior tibiæ in ♂ somewhat dilated. Forewings in ♂ with a large swollen scaled gland between cell and vein 1b towards base; 10 absent, 11 anastomosing with 12 and 9. Hindwings normal.

The single species is endemic.

[redacted]

84. *Ner. verrucata*, Gn.

(*Neritodes verrucata*, Gn. X, 119, pl. XXII, 8.)

♂♀. 29-32 mm. Antennal ciliations $\frac{1}{3}$. Forewings with hindmargin gently rounded; pale greyish-ochreous, more or less fuscous-tinged towards costa or generally, sometimes faintly reddish-tinged in disc, sometimes with scattered dark fuscous scales; second line nearly straight, hardly defined, fuscous, usually marked with dark fuscous dots on veins; a hindmarginal series of small blackish dots. Hindwings with hindmargin rounded; pale whitish-ochreous, more whitish towards costa, somewhat sprinkled with fuscous posteriorly; second line indicated on lower half by a curved series of faint grey dots.

Glen Innes (3500 feet), Sydney and Bathurst, (2300 feet), New South Wales; Melbourne, Victoria; Hobart, Tasmania; Mount Lofty and Port Lincoln, South Australia; from August to December, and in March and April, common, frequenting swampy ground.

[redacted]

3. Forewings without transverse fascia .... 85. *punctilinea.*
   Forewings with transverse fascia......... ... 4.
4. Forewings with one fascia only........ ...... 86. *selenaea.*
   Forewings with second fascia and connecting streak.................................... ... 87. *clara.*

85. *Thal. punctilinea*, Walk.

(*Thalaina punctilinea*, Walk. Suppl. 288.)

♀. 51 mm. Head deep ferruginous-orange, face blackish, becoming whitish beneath. Thorax white, anterior margin broadly pale brownish, with a small orange spot on each shoulder. Forewings with apex very slightly prominent, hindmargin rounded, slightly waved; 11 anastomosing with 12 only; silvery-white; a deep ferruginous-orange streak along basal fifth of costa, margined beneath by a black dot at base; a few black and orange scales on inner margin towards middle: cilia deep ferruginous-orange, becoming white towards anal angle. Hindwings with hindmargin rounded, waved; white; a small irregular grey spot towards apex. Undersurface of hindwings white, with a large round apical blotch, of which upper half is deep orange except towards hindmargin, where it is light purplish-grey, lower half black.

Melbourne, Victoria; also in Tasmania; two specimens. This may possibly be a variety of the following species, but as no connecting forms have occurred, it is desirable to keep them separate at present.

86. *Thal. selenaea*, Dbld.

(*Callimorpha selenaea*, Dbld., Eyre's Disc. Austr. I, 437, pl. v, 3; *Absyrtes magnificaria*, Chen., Hist. Nat. Pap. 5, Gn. X, 226; *Thalaina klenaea*, Walk. Bomb. 660; *T. australiaria*, HS., Exot. 333.)

♀. 45-52 mm. Head deep ferruginous-orange, face blackish. Forewings with apex slightly prominent, hindmargin rounded, slightly waved; 11 anastomosing with 12 only; silvery-white; a deep ferruginous-orange streak along basal fifth of costa, sometimes

continued to reach fascia; a straight narrow deep ferruginous-orange fascia, edged with black except near costa, running from costa before $\frac{2}{3}$ to anal angle, which it hardly reaches, posterior margin forming a projection outwards in middle; some orange and black scales on inner margin towards middle, or sometimes an orange black-margined streak along inner margin from near base to anal angle: cilia orange, becoming white towards anal angle. Hindwings with hindmargin rounded, waved; sometimes a small grey spot towards apex. Undersurface of hindwings white, with a large round subapical blotch, of which upper half is deep orange, lower half black.

Sydney, New South Wales; Melbourne, Victoria; three specimens.

87. *Thal. clara*, Walk.

(*Thalaina clara*, Walk. Bomb. 660.)

♂♀. 34-36 mm. Head deep ferruginous-orange, forehead dark fuscous, face white. Antennal ciliations of ♂ $\frac{1}{8}$. Thorax white,

in habits, and usually taken at lamps; characteristics probably shared by all the species of the genus.

88. *Thal. angulosa*, Walk.

(*Thalaina angulosa*, Walk. Suppl. 289.)

♀. 48 mm. Head orange, face whitish. Thorax white, anteriorly ochreous-tinged, with an orange spot on shoulders. Forewings silvery-white; markings orange, black-margined; a moderate streak from base along costa, thence straight to middle of inner margin; a streak from middle of this to anal angle, meeting apex of a dorsal streak from near base, and another from costa at $\frac{3}{4}$ (its anterior angle produced) to apex of median streak: cilia orange. Hindwings white; a moderate dark fuscous fascia from costa near apex to anal angle, much dilated above middle, where it touches hindmargin with three projections. Undersurface of hindwings with same markings, but upper half of dilation orange.

Adelaide, South Australia; one specimen (*Coll.* Lucas).

89. *Thal. inscripta*, Walk.

(*Thalaina inscripta*, Walk. Bomb. 661; *T. principaria*, HS. Exot. 446, Gn. X, 227.)

♂♀. 36-38 mm. Head white, crown mixed with greyish-ochreous. Antennal ciliations of ♂ $\frac{1}{6}$. Forewings with apex slightly prominent, hindmargin bowed, slightly waved; 11 anastomosing with 12 and 10; silvery-white; markings light yellowish-brown, edged with dark fuscous; a streak along basal fourth of costa; a streak along inner margin from near base to anal angle, and sometimes a broader streak along submedian fold from before middle, confluent posteriorly with this and with first fascia; a narrow nearly straight or somewhat irregular fascia from or near costa about $\frac{2}{3}$ to anal angle; an irregular variable streak running from this fascia above middle to middle of hindmargin, sometimes interrupted before junction with second fascia; second fascia obtusely angulated inwards near costa, running from costa at $\frac{5}{6}$ to meet longitudinal median streak before hindmargin;

an oblique apical mark, two oval spots on hindmargin above middle, upper often confluent with apical mark, and two others below middle: cilia white, partially spotted with brown. Hindwings with hindmargin rounded, somewhat waved; white; a moderate suboval or irregular blackish-grey subapical spot. Undersurface of hindwings white with a black subapical blotch.

Bathurst (2300 feet), New South Wales; also in Tasmania; in April, three specimens.

27. Mnesampela, n.g.

Face obtusely prominent, with short projecting scales. Tongue developed. Palpi moderate, subascending, rough-scaled, terminal joint very short. Antennæ in ♂ filiform, minutely ciliated, or subpectinated, pectinations broad or lamelliform, clavate. Thorax not crested, densely hairy above and beneath. Femora hairy beneath; posterior tibiæ in ♂ dilated, containing tuft. Forewings in ♂ without fovea; 10 out of 9. Hindwings normal.

Includes only the Australian species. In this instance the [redacted]

prominent, hindmargin strongly bowed so as to be almost bent on vein 5; light brown-reddish, scantily irregularly irrorated with short blackish-grey strigulæ, median and subterminal bands somewhat paler and whitish-tinged, latter terminating in a whitish costal blotch; lines obscurely indicated by confluence of irroration; median slightly curved, on lower half mixed with white and black scales, terminating in a dilated spot on inner margin; second tolerably parallel to hindmargin; a moderate discal dot: cilia dark reddish-brown, obscurely spotted with blackish, tips white. Hindwings with hindmargin rounded, waved; ochreous-whitish, thinly sprinkled with short grey strigulæ; a grey discal dot; a rather broad light reddish hindmarginal band, more closely irrorated with grey strigulæ; cilia dark grey, spotted with blackish, tips white.

Melbourne and Warragul, Victoria; two specimens (*Coll. Lucas*).

91. *Mnes. lenaea*, n.sp.

♂♀. 38-40 mm. Antennæ in ♂ with short lamelliform broadly clavate pectinations (1). Forewings with apex prominent, hindmargin strongly bowed so as to be almost bent on vein 5; pale ashy-grey, slightly purplish-tinged, with scattered blackish scales, apex more whitish-tinged, in ♀ suffused with ochreous on basal half and towards inner margin, scales on this area more or less raised so as to appear strigulated with lighter and darker; median shade and second line parallel, thick, cloudy, ill-defined, in ♂ fuscous, in ♀ ochreous, somewhat curved, bent above middle, slightly sinuate below middle; a large obscure darker fuscous discal dot, placed on median shade: cilia dark ochreous-brown, tips whitish. Hindwings with hindmargin unevenly rounded, strongly waved; dull whitish or whitish-ochreous, strewn with grey strigulæ or dots, posterior half distinctly purplish-tinged; a large cloudy dark grey discal dot.

Bathurst (2300 feet), New South Wales; Melbourne, Victoria; Mount Lofty, South Australia; in March, three specimens.

92. *Mnes. privata*, Gn.

(*Idiodes privata*, Gn. IX, 41, pl. xiv, 4.)

♂♀. 40-43 mm. Antennæ in ♂ filiform, ciliations ⅛. Forewings with apex prominent, hindmargin waved, strongly bowed so as to be almost bent on vein 5; light ochreous, with short scattered grey strigulæ and a few blackish scales; basal half more brownish or reddish-tinged, with somewhat raised scales; median shade rather broad, cloudy, light reddish-fuscous, forming obtuse angles outwards above and below middle, inwards in middle and above inner margin; a cloudy dark grey discal dot beyond this; second line formed by a cloudy hardly darker ochreous shade, slightly curved above middle. Hindwings with hindmargin unevenly rounded, strongly waved; deep ochreous-yellow, somewhat deeper and more ochreous towards hindmargin; a few dark grey scales towards hindmargin; a dark grey discal dot, sometimes indistinct; cilia dark ochreous-fuscous, tips whitish.

Sydney, New South Wales; Melbourne, Victoria; Mount [redacted]

28. Criomacha, n.g.

Face with strong truncate-conical projection. Tongue developed. Palpi moderate, subascending, rough-scaled, terminal joint moderate. Antennæ in ♂ bipectinated throughout. Thorax with central triangular crest on back, densely hairy beneath. Femora hairy beneath; anterior tibiæ in both sexes with horny apical hook above, posterior tibiæ in ♂ not dilated. Forewings in ♂ without fovea; 10 out of 9, 11 sometimes connected with 12.

Restricted to the single Australian species.

94. *Criom. belidearia*, Feld.

(*Chlenias belidearia*, Feld. pl. cxxiv, 9.)

♂♀. 47-57 mm. Antennal pectinations in ♂ 6. Forewings with apex slightly prominent, hindmargin rather strongly bowed, waved; in ♂ deep brown-red, with scattered dark purple-fuscous scales, in ♀ light brownish-ochreous mixed or suffused with light brown-reddish, with scattered short dark grey strigulæ; a somewhat darker suffusion towards inner margin; first line cloudy, blackish, dentate, slightly bent in middle, or more usually reduced to a dark fuscous dot in disc and an oblique mark on inner margin; a dark purple-fuscous transverse discal dot; second line cloudy, blackish, dentate, nearly straight, dilated on costa, or more usually reduced to a series of dark fuscous dots on veins. Hindwings with hindmargin unevenly rounded, waved; light fuscous or pale whitish-ochreous, towards costa more whitish, with a broad suffused purple-fuscous or reddish-grey hindmarginal band; veins sometimes suffused with pale reddish.

Melbourne, Victoria; Mount Lofty, South Australia; in May; four specimens received from Mr. E. Guest.

29. Stathmorrhopa, n.g.

Face somewhat prominent, with short projecting scales. Tongue developed. Palpi moderate, subascending, rough-scaled, terminal joint short. Antennæ in ♂ bipectinated throughout. Thorax with triangular central crest, beneath densely hairy. Femora densely hairy beneath, posterior tibiæ in ♂ not dilated. Fore-

wings in ♂ without fovea; 10 out of 9, 11 anastomosing or connected with 12 and 10. Hindwings with veins 3 and 4 often from a point.

Contains only the following; a stout and heavily built insect.

95. *Stath. beggaria*, Gn.

(*Chlenias beggaria*, Gn. X, 238, pl. XIV, 2; ? *C. porphyrinaria*, ib. 237.)

♂♀. 50-57 mm. Antennal pectinations of ♂ 4. Forewings suboblong, apex slightly prominent, hindmargin rather strongly bowed, waved, surface in ♀ slightly wrinkled transversely; fuscous, irrorated with darker fuscous between veins; veins sometimes slightly reddish-tinged; a small ill-defined cloudy dark fuscous discal spot. Hindwings with hindmargin unevenly rounded, waved; whitish-fuscous, in ♂ more whitish, especially towards costa and base; sometimes a dark grey transverse discal mark; a broad suffused rather dark fuscous hindmarginal band, [redacted]

brown, with scattered dark fuscous scales, especially along costa; a streak along submedian fold irrorated with whitish; first and second lines obscurely pale, with a few whitish scales, becoming whitish on submedian fold, dentate, rather nearly approximated on submedian fold, where they are connected by a dark fuscous suffusion; a blackish discal dot; subterminal slender, whitish, dentate, interrupted, forming a white spot on submedian fold: cilia fuscous. Hindwings with hindmargin rounded, sinuate on upper half; fuscous-whitish, tinged with reddish-ochreous, more strongly posteriorly; a pale cloudy waved subterminal line, preceded by a cloudy light fuscous shade.

Tasmania (?); one specimen, received from Mr. A. Simson.

31. Mictodoca, n.g.

Face with appressed scales. Tongue developed. Palpi moderately long, porrected, with long rough scales, terminal joint rather short, filiform. Antennæ in ♂ bipectinated to apex. Thorax not crested (?), hairy beneath. Femora hairy beneath; posterior tibiæ in ♂ not dilated. Forewings in ♂ without fovea; 10 connected or anastomosing with 11 and 9. Hindwings normal.

Only the one species is known.

97. *Mict. toxeuta*, n.sp.

♂. 34 mm. Forewings with hindmargin bowed; oblique; light fuscous, in disc and towards base somewhat suffused with ochreous-brown; a short oblique black streak from base of costa, and a second less marked near beyond it; first line ill-defined, blackish, thrice very sharply dentate, nearly preceded by a similar roughly parallel line; veins here and there faintly marked with blackish; second line somewhat curved, shortly dentate, blackish, followed by a faint whitish line expanding into an irregular spot above middle, crossing and partially obscuring second line; subterminal thick, obscurely paler, partially whitish, running from apex to $\frac{3}{4}$ of inner margin, twice sinuate inwards, preceded by an irregular ochreous-brown shade, cut by four black streaks on veins above

middle; an interrupted black hindmarginal line: cilia grey-whitish, barred with fuscous, with a cloudy fuscous line. Hindwings with hindmargin rounded; pale greyish-fuscous, becoming darker posteriorly.

Newcastle, New South Wales; one specimen (Australian Museum).

32. Chlenias, Gn.

Face shortly rough-scaled or with projection of scales, or forming a rounded flattened prominence, or with long horny projecting plate. Tongue developed. Palpi moderate, porrected, rough-scaled, terminal joint moderate. Antennæ in ♂ bipectinated throughout. Thorax with anterior triangular crest, beneath densely hairy. Femora hairy beneath; posterior tibiæ in ♂ not dilated. Forewings in ♂ without fovea; 10 connected or anastomosing with 9. Hindwings normal.

As restricted, the genus is at present confined to Australia.

[redacted]

98. *Chlen. arietaria*, Gn.

(*Chlenias arietaria*, Gn. X, 239; *Chemerina cuneifera*, Walk. 1155; *Ciampa defixella*, ib. Cr. 180; *Chlenias crambaria*, Feld. pl. CXXXIII, 12.)

♂♀. 33-38 mm. Face with long horny projecting median plate, angularly emarginate at extremity, and a horny ridge on lower margin. Antennal pectinations in ♂ 8. Abdomen clothed with shining brownish-ochreous scales towards base. Forewings very elongate-triangular, narrower in ♀, hindmargin obliquely rounded; light fuscous, mixed with dark fuscous and whitish, posteriorly and on subcostal and dorsal streaks often suffused with pale ochreous; veins more or less marked with white in disc; spaces between veins and within cell marked with blackish streaks except towards costa, these streaks sometimes more or less wholly obsolete; lines dentate, dark fuscous, confused and incomplete, first angulated in middle, second nearly straight; subterminal slender, white, dentate. Hindwings with hindmargin sinuate-rounded; grey-whitish, towards hindmargin more greyish-tinged.

Newcastle, Sydney, and Bathurst (2300 feet), New South Wales; Melbourne, Victoria; Adelaide, South Australia; in April and May, rather common. The variety with the black streaks suppressed has at first sight a distinct appearance, but all the intermediate forms occur.

99. *Chlen. melanoxysta*, n.sp.

♀. 35 mm. Head and thorax light reddish; face rather protuberant, pale ochreous; thorax with some blackish-grey scales. Forewings elongate-triangular, hindmargin bowed, oblique, slightly waved; pale ochreous-brownish, irrorated with fuscous; a costal streak, and parts of veins, irrorated with dark red; numerous scattered cloudy blackish-grey dots; first line obsolete; second line cloudy, fuscous, very indistinct, hardly curved; subterminal indicated by cloudy fuscous indistinct anterior margin, marked with blackish-grey above middle and on a dot at $\frac{3}{4}$ from costa; a strong black dorsal streak from $\frac{1}{5}$ to anal

angle. Hindwings with hindmargin rounded, unevenly waved; whitish-grey, on posterior half rather thickly irrorated with dark grey.

Balaclava, South Australia; one specimen (*Coll.* Guest), taken in April.

100. *Chlen. umbraticaria*, Gn.

(*Chlenias umbraticaria*, Gn. X, 240.)

♂♀. 41-43 mm. Face broadly rounded-prominent. Antennal pectinations in ♂ 6. Forewings elongate-triangular, more elongate in ♀, hindmargin bowed, rather strongly oblique, waved; light fuscous, densely irrorated with white; median and submedian folds and posterior interneural spaces marked with fine black longitudinal lines; first and second lines and median shade cloudy, darker fuscous, sometimes nearly obsolete, closely approximated on lower half, first strongly curved, median angulated but hardly traceable, second somewhat curved on upper half, waved. Hindwings with hindmargin unevenly rounded, sinuate above

sometimes almost obsolete; median shade slender, cloudy, dark fuscous, angulated outwards beneath costa and in middle, inwards above and below middle, in ♀ sometimes obsolete; second line whitish, cloudy, shortly dentate, anteriorly edged with dark fuscous, upper half somewhat curved outwards, lower somewhat sinuate inwards; a more marked ochreous suffusion beyond this above middle and above inner margin. Hindwings with hindmargin unevenly rounded, sinuate above middle; pale fuscous, becoming darker posteriorly.

Sydney, New South Wales; Melbourne, Victoria; Mount Lofty, South Australia; from March to July, rather common.

102. *Chlen. zonaea*, n.sp.

♂♀. 37-39 mm. Face flat. Antennal pectinations in ♂ 6. Thorax blackish-fuscous mixed with whitish. Forewings very elongate-triangular, handmargin obliquely bowed, waved; fuscous, densely irrorated with white and in ♀ with black; veins partially marked with black except posteriorly, where there are more or less marked black interneural streaks instead; a small white mark at base; first and second lines and median shade cloudy, dark fuscous, evenly curved, first in ♂ partially preceded by a white suffusion, second in ♂ followed by a cloudy white subdentate line; a dark fuscous spot in ♂ beyond this above middle, surmounted by a slight pale ochreous suffusion, and another above inner margin; subterminal indicated by whitish dots on veins, in ♀ obsolete. Hindwings with hindmargin unevenly rounded, sinuate above middle; fuscous, becoming whitish-fuscous towards base; sometimes an obscure darker transverse discal mark.

Melbourne, Victoria; Mount Lofty, South Australia; from March to June, five specimens. Larva 10-legged, longitudinally banded as follows; a dorsal orange stripe, then four wavy black lines with bluish-white interspaces, then a broad pale yellow stripe, then four more black lines, the three last interrupted and space between them yellowish-white, then a broad black line, below this yellowish with four purple wavy lines; spiracles orange; head yellowish: feeds on *Aster axillaris*, in August and September.

103. *Chlen. seminigra*, Ros.

(*Chlenias seminigra*, Ros., Ann. Mag. Nat. Hist. 1885, 430.)

♂♀. 44-46 mm. Head and thorax black; face flat. Antennal pectinations in ♂ very long. Forewings very elongate-triangular, hindmargin bowed, oblique, not waved; rather dark brown; wholly suffused with dark fuscous except a rather broad hindmarginal band which is partially suffused with dark fuscous towards anal angle; costa sometimes rather broadly ochreous-brown; second line sometimes perceptible, dentate, parallel to hindmargin. Hindwings with hindmargin unevenly rounded, sinuate above middle; very pale whitish-fuscous, hindmargin slightly brownish-tinged; a dark fuscous transverse discal mark.

Warragul, Victoria; two specimens.

104. *Chlen. carburaria*, Gn.

(*Chlenias carburaria*, Gn. X, 238.)

♂♀. 38 mm. Thorax dark brown, collar cinnamon-brown,

[redacted]

slightly dilated. Forewings in ♂ without fovea; 10 connected with 12 and 9, 11 out of 10 between connections. Hindwings normal.

Contains the following species only.

105. *Smyr. aplectaria*, Gn.

(*Smyriodes aplectaria*, Gn. IX, 223, pl. xx, 1; *Nisista notodontaria*, Walk. 294; *Vunga delineata*, ib. Suppl. 453.)

♂. 33-40 mm. Antennal pectinations 6. Forewings elongate-triangular, hindmargin bowed, dentate; light fuscous, partially ochreous-tinged, indistinctly strigulated with darker; a fine blackish transverse line near base, angulated beneath costa; a round blackish suffusion on lower half between this and first line; first line slender, blackish, somewhat irregular, curved; median shade cloudy, blackish, ill-marked, rectangularly angulated outwards above middle and sinuate inwards below middle; second line slender, blackish, running from costa beyond middle to $\frac{2}{3}$ of inner margin, angulated outwards beneath costa and above middle, sinuate inwards between angulations and on lower half; subterminal irregular, cloudy, pale, more whitish at extremities, anteriorly more or less distinctly margined with dark fuscous suffusion, marked with two or three short black streaks between veins above middle; a short oblique blackish-fuscous streak from apex; a fine black hindmarginal line. Hindwings with hindmargin rounded, subdentate; fuscous-grey, becoming whitish-grey towards base; an indistinct slender irregular darker line beyond middle; subterminal faintly paler.

Mount Lofty, South Australia; also from Tasmania; in May, three specimens. Larva 10-legged; apple-green; dorsal light crimson; spiracular pale yellow; spiracles orange-yellow, black-centred: feeds on a prickly species of *Pultenaea*. It has been bred by Mr. E. Guest, to whom I am indebted for this information.

34. Gastrina, Gn.

Face with slightly projecting scales. Tongue developed. Palpi moderate, subascending, rough-scaled, terminal joint short. An-

tennæ in ♂ bipectinated, apex simple. Thorax with posterior crest, densely hairy beneath. Abdomen with strong dorsal crests. Femora glabrous; posterior tibiæ in ♂ strongly dilated, containing tuft, outer apical spur very short, thick. Forewings in ♂ without fovea; 10 out of 9, connected again with 9. Hindwings normal.

Only the one species is known.

106. *Gastr. cristaria*, Gn.

(*Gastrina cristaria*, Gn. IX, 224, pl. v, 4; *Praxis illapsa*, Walk. Noct. 1088; *Hypochroma velutinata*, ib. Geom. 442; *Passa latifasciata*, ib. Suppl. 1563.)

♂. 33 mm. Antennal pectinations 3. Forewings elongate-triangular, hindmargin bowed, subdentate; light brownish-ochreous, with scattered dark brown strigulæ and blackish scales; basal area ochreous-brown, becoming black on inner margin, except at base, which is whitish; first line blackish, gently curved, anteriorly edged with whitish-ochreous; median shade cloudy, [redacted]

35. STIBAROMA, n.g.

Face slightly prominent, with short projecting scales. Tongue developed. Palpi moderate, ascending, rough-scaled, terminal joint very short. Antennæ in ♂ bipectinated, apex simple. Thorax with slight central crest, densely hairy beneath. Femora hairy beneath, posterior tibiæ in ♂ not dilated. Forewings in ♂ without fovea; 10 connected with 9. Hindwings with veins 3 and 4 from a point.

Formed to include the following species.

107. *Stib. melanotoxa*, n.sp.

♂♀. 38-43 mm. Head and thorax dark grey irrorated with whitish. Antennal pectinations of ♂ 4. Forewings elongate-triangular, hindmargin somewhat waved, hardly oblique, nearly straight, rounded beneath; fuscous-grey, irrorated with white, with scattered black scales; veins marked by fine black lines; sometimes a short black transverse line from costa near base; first line black, curved, or twice angularly dentate outwards, variable; median shade dark fuscous or black, angulated in middle, sinuate inwards on lower half; second line black, from beyond $\frac{2}{3}$ of costa to $\frac{1}{3}$ of inner margin, angulated in middle, sinuate inwards on lower half; subterminal cloudy, whitish, dentate on upper half, suffusedly margined with darker fuscous, more broadly anteriorly; a sharp black hindmarginal line: cilia grey-whitish, with two grey lines, and barred with grey. Hindwings with hindmargin rounded, unevenly waved; in ♂ whitish, in ♀ grey; a broad dark grey hindmarginal band, its anterior edge straight, so that it is narrowed to a point at anal angle; in ♀ a dark grey discal dot and slender postmedian line; a black hindmarginal line; cilia whitish, spotted with dark grey on veins.

Wimmera district, Victoria; Mount Lofty, South Australia; received from Mr. E. Guest and Dr. Lucas; four specimens. The species varies in the intensity of marking and in the form of the lines; the variability of the first line in particular is singularly great. Larva 10-legged; yellowish-green; dorsal purplish-brown; lateral pale yellow; head greenish-orange; feeds on

Eucalyptus sp. (white gum). It has been bred by Mr. Guest, who sent me the foregoing information.

36. Drymoptila, n.g.

Face with appressed scales. Tongue developed. Palpi moderate, porrected, shortly rough-scaled, terminal joint short. Antennæ in ♂ filiform, shortly ciliated. Thorax with dense posterior crest, somewhat hairy beneath. Femora glabrous. Forewings in ♂ without fovea; 10 and 11 separate. Hindwings normal.

Founded on the following species; allied to *Stibaroma*.

108. *Drym. temenitis*, n.sp.

♂. 26 mm. Forewings elongate-triangular, costa strongly arched near base, slightly sinuate in middle, hindmargin rather obliquely rounded, waved; grey, slightly brownish-tinged, with faint darker strigulations; first line black, well-marked, running from 1/3 of costa to 1/3 of inner margin, hardly [redacted]

hairy. Femora hairy beneath; posterior tibiæ in ♂ not dilated. Forewings in ♂ without fovea; 10 out of 9, sometimes anastomosing again with 9, 11 anastomosing with 12 and 10. Hindwings with veins 3 and 4 from a point or stalked.

The single species is West Australian.

109. *Par. promacha*, n.sp.

♂♀, 26-29 mm. Antennal pectinations of ♂ 3. Forewings very elongate-triangular, costa abruptly arched near base, thence straight, hindmargin somewhat oblique, crenulate, obtusely angulated in middle; pale fuscous-grey, partially ochreous-tinged, with scattered dark fuscous scales; costa strigulated with dark fuscous; a straight blackish line near base, externally suffused with ochreous; first line fuscous, sometimes marked with blackish, from $\frac{1}{5}$ of costa to $\frac{2}{5}$ of inner margin, angulated in middle and near inner margin; median shade fuscous, angulated in middle; a blackish discal dot beyond this; second line from $\frac{3}{4}$ of costa to $\frac{3}{4}$ of inner margin, angulated parallel to hindmargin, grey-whitish, margined by two much interrupted fine dark fuscous lines, posterior mixed with reddish-fuscous; a more or less distinct darker grey suffused streak along submedian fold from first line to subterminal, and another above middle from median shade to subterminal line; subterminal faint, whitish, running from apex to anal angle, subdentate; a fine black interrupted hindmarginal line. Hindwings with hindmargin forming an acute triangular projection in middle, upper half irregularly crenate, lower half straight; grey-whitish; a dark grey discal dot; second line slender, grey, rather irregular; a grey hindmarginal band, including an obscure whitish subterminal line; a fine black hindmarginal line. Undersurface of hindwings with markings more blackish and defined, anterior margin of subterminal line forming an elongate-oval transverse blackish-fuscous blotch on upper half and a small spot at anal angle.

Albany, West Australia; in September and October, five specimens.

38. Neoteristis, n.g.

Face with projection of scales. Tongue developed. Palpi very long, straight, porrected, rough-scaled, terminal joint moderate. Antennæ in ♂—(?) Thorax not crested (?), densely hairy beneath. Femora smooth. Forewings with veins 10 and 11 separate. Hindwings normal.

Although the ♂ is unknown, I am unable to include this species in any other genus, but in superficial appearance it most nearly approaches the preceding; the unusually long palpi made it easy of recognition, otherwise I should not have ventured to describe it.

110. *Neot. paraphanes*, n.sp.

♀. 34 mm. Palpi four times width of eye. Forewings very elongate-triangular, almost oblong, costa abruptly arched near base, where it is roughened with projecting scales, hindmargin oblique, strongly bowed so as to be almost bent on vein 4; light fuscous-grey, much suffused with white, with scattered dark [redacted]

Of this genus also the ♂ is unknown ; but it appears to differ from its nearest allies in neuration too markedly to be united with them.

111. *Mochl. phasmatias*, n. sp.

♀. 64 mm. Head and thorax white, with a few black scales. Forewings very elongate-triangular, hindmargin somewhat obliquely rounded, waved ; white, with a few scattered black and fuscous scales, especially towards costa anteriorly ; a small reddish-ochreous discal spot ; some reddish-ochreous scales indicating three obscure very imperfect lines, hardly traceable, first from $\frac{1}{3}$ of costa to $\frac{2}{5}$ of inner margin, second from $\frac{2}{3}$ of costa to $\frac{2}{3}$ of inner margin, curved outwards on upper half, third subterminal : cilia white, with a series of blackish semilunate marks between veins. Hindwings whitish, with a very broad blackish-grey hindmarginal band ; cilia white.

Warragul, Victoria ; one specimen (*Coll.* Lucas).

Appendix.

The following names, nominally or actually referable to species of the family, have not been included above, for various reasons as explained.

112. *Epione incaria*, Gn. IX, 97. I cannot identify this at all.

113. *Ellopia cumularia*, Gn. IX, 133, pl. v, 5 I have seen nothing like this, and doubt if it is really Australian.

114. *Tetracis cachexiata*, Gn. IX, 142. Unidentified ; perhaps not Australian.

115. *Crocallis newmannaria*, Gn. IX, 169. Unidentified ; probably allied to the *Chlenias* group.

116. *Tephrosia bispinaria*, Gn. IX, 266. Probably a *Selidosema* ; unidentified.

117. *Fidonia amitaria*, Gn. X, 155. Very likely only a form of the European *atomaria*, judging from the description ; the Australian locality is doubtless an error.

118. *Zerene devinctaria*, Gn. X, 222, pl. VIII, 3. I have no doubt that this is another error of locality; the species appears to be identical with the American *catenaria*.

119. *Chlenias galearia*, Gn. X, 238. Unidentified; but the description is very vague.

120. *Tephrosia excesaria*, Gn. IX, 270. Unidentified.

In order to conclude the *Geometrina*, I add here the single Australian species of the *Desmobathridae*. I may mention that the *Strophidiadae*, which I once included in the *Geometrina*, are truly referable, as I am now satisfied, to the *Bombycina*. The order of the five families of *Geometrina*, to show their mutual relations, should be as follows: 1, *Hydriomenidae*; 2, *Monocteniadae*; 3, *Desmobathridae*; 4, *Geometridae*; 5, *Selidosemidae*.

DESMOBATHRIDAE.

Ocelli and maxillary palpi usually obsolete. Forewings with [redacted]

gently bowed, slightly waved; prismatic white, thinly scaled; costa finely dotted with dark fuscous; lines indicated by series of dark fuscous dots on veins, first somewhat curved, second from $\frac{5}{6}$ of costa to $\frac{2}{3}$ of inner margin, sinuate outwards in middle; a round black discal dot; some fuscous scales indicating subterminal line; a hindmarginal series of black dots: cilia white. Hindwings with hindmargin rounded, hardly waved; colour and markings as in forewings (except costal dots), but first line absent, second line strongly angulated in middle.

Queensland; one specimen received from Dr. T. P. Lucas.

INDEX OF GENERA.

Amelora, n.g. .... 24.
Aporoctena, n.g. .... 11.
Chlenias, Gn. .... 32.
Conosara, n.g. .... 30.
Cosymbia, Hb. .... 6.
Criomacha, n.g. .... 28.
Deilinia, Hb. .... 17.
Diastictis, Hb. .... 2.
Discalma, n.g. .... 5.
Drymoptila, n.g. .... 36.
Ectropis, Hb. .... 14.
Epicompsa, n.g. .... 1.
Gastrina, Gn. .... 34.
Hybernia, Latr. .... 12.
Hyposidra, Gn. .... 3.
Idiodes, Gn. .... 21.
Lomographa, Hb. .... 16.
Lophodes, Gn. .... 9.
Melanodes, Gn. .... 10.
Metrocampa, Latr. .... 22.
Mictodoca, n.g. .... 31.
Mnesampela, n.g. .... 27.
Mochlotona, n.g. .... 39.
Neoteristis, n.g. .... 38.
Neritodes, Gn. .... 25.
Osteodes, Gn. .... 4.
Paralaea, n.g. .... 37.
Planolocha, n.g. .... 23.
Proboloptera, n.g. .... 20.
Psilosticha, n.g. .... 13.
Rhinodia, Gn. .... 19.
Scardamia, Gn. .... 18.
Scioglyptis, n.g. .... 7.
Selidosema, Hb. .... 8.
Smyriodes, Gn. .... 33.
Stathmorrhopa, n.g. .... 29.
Stibaroma, n.g. .... 35.
Thalaina, Walk. .... 26.
Tigridoptera, HS. .... 15.
Zanclopteryx, HS. .... 40.

Index of Species.

The numbers refer to those prefixed to each species in order. Names printed in italics are synonyms.

absorpta, Walk. .... 47.
acaciaria, Boisd. .... 40.
ada, Butl. .... 73.
adelphodes, n.sp. .... 31.
adustaria, Walk. .... 8.
aganopa, n.sp. .... 30.
agoraea, n.sp. .... 27.
agrealesaria, Walk. .... 4.
alienaria, Walk. .... 40.
allogata, Feld. .... 68.
amblopa, n.sp. .... 78.
amitaria, Gn. ....117.
amphiclina, n.sp. .... 14.
beggaria, Gn. .... 95.
belidearia, Feld. .... 94.
bispinaria, Gn. ....116.
bitaeniaria, Le G. .... 39.
boreophilaria, Gn. .... 46.
cachexiata, Gn. ....114.
camelaria, Gn. .... 54.
canescaria, Gn. .... 20.
capnota, n.sp. .... 23.
carburaria, Gn. ....104.
castanea, n.sp. .... 96.
catacris, n.sp. .... 81.
cheleuta, n.sp. .... 13.

devinctaria, Gn.............118.
diffusata, Walk............. 4.
disperdita, Walk............ 28.
displicata, Walk............ 40.
disposita, Walk............. 51.
disrupta, Walk.............. 12.
dissonata, Walk............. 53.
eccentritis, n.sp............. 60.
embolias, n.sp............... 69.
epistictis, Meyr............. 42.
erebina, Walk............... 39.
eremias, n.sp................ 15.
euboliaria, Walk............ 37.
excursaria, Gn.............. 29.
excursaria, Walk........... 12.
exesaria, Gn.................120.
exfusaria, Walk............ 6.
exportaria, Gn............... 29.
exprimataria, Walk........ 22.
exsuperata, Walk.......... 51.
externaria, Walk........... 19.
ferritinctaria, Walk........ 5.
fractaria, Gn............... 53.
fractata, Walk.............. 37.
frontaria, Walk............. 2.
fucata, Feld................ 93.
galearia, Gn................119.
gelidaria, Walk............. 40.
glaucias, n.sp............... 72.
goniota, n.sp................ 75.
gratularia, Walk..........2, 17.
hemeropa, n.sp............. 11.
illapsa, Walk................106.
illustraria, Walk........... 41.
impressaria, Walk......... 62.
incaria, Gn.................112.
indecisata, Walk............101.
indirecta, Walk............. 34.
indocilisaria, Walk......... 46.
inductaria, Walk............ 71.
infixaria, Walk.............. 2.
infusata, Walk............... 4.
inscripta, Walk............. 89.
inspirata, Gn................ 71.
integraria, Walk............ 47.
introducta, Walk............ 71.
irrorata, Butl............... 61.
isocyma, n.sp............... 59.
isombra, n.sp............... 50.
janiaria, Gn................. 4.
jucundaria, Walk.......... 68.
klenaea, Walk............... 86.
latifasciata, Walk..........106.
lenaea, n.sp.................. 91.
leptodesma, n.sp........... 25.
leucaniata, Gn.............. 83.
leucoplecta, n.sp........... 26.
lithinopa, n.sp.............. 10.
lithodora, n.sp............... 64.
luxaria, Gn.................. 28.
lyciaria, Gn.................. 21.
mactaria, Gn................. 47.
magnificaria, Chen......... 86.
margaritis, n.sp.............. 3.
mariana, White............. 55.
matutinata, Walk.......... 56.
melanotoxa, n.sp............107.
melanoxysta, n.sp.......... 99.
milvaria, Gn................. 80.
mitigata, Gn................. 71.
mundifera, Walk............ 12.
newmannaria, Gn..........115.

nigraria, Feld............... 53.
normata, Walk.............. 6.
notodontaria, Walk.........105.
ochthadia, n.sp............... 66.
oenias, n.sp... .... 63.
pallidiscaria, Walk......... 32.
panagraria, Walk.......... 2.
paraphanes, n.sp............110.
penthearia, Gn.............. 8.
perfectaria, Walk........... 36.
permensata, Walk..........121.
phasmatias, n.sp............111.
phibalopteraria, Gn......... 29.
poecilaria, Gn............ .. 21.
porphyrinaria, Gn.......... 95.
porrectaria, Walk.......... 2.
p[illegible], Walk . . 70.
rostraria, Gn................. 68.
rotundata, Butl.............. 57.
rupicolor, Butl.............. 7.
scierodes, n.sp............... 45.
selenaea, Dbld .... 86.
seminigra, Ros...............103.
semitata, Walk.............. 21.
siculoides, Walk............. 71.
silicaria, Gn................. 12.
sinistraria, Gn........... ... 43.
sparsularia, Gn.............. 76.
spodina, n.sp................. 58.
suasaria, Gn... .... 17.
subtinctaria, Walk......... 32.
temenitis, n.sp...............108.
thermaea, n.sp .... 16.
to[illegible]ta, n.sp . ... 97.

ON TWO UNDESCRIBED EXUDATIONS FROM THE LEGUMINOSÆ.

By J. H. Maiden, F.L.S., &c.

1. A kino from the "Native Wistaria," *Milletia (Wistaria) megasperma*, F.v.M.

This "vine" runs to an enormous length up and down trees and along the ground. Bushmen appear to know in a general way of the existence of an exudation from it, but I can find no reference to any exudation whatever from this or any other *Milletia* or *Wistaria* in any part of the world. Not only are the stems of the "Native Wistaria" of great length, but they are also of great thickness, so that a large quantity of the exudation could be obtained, if required, as it flows freely. The pods also occasionally show small globules of kino.

This exudation is a beautiful ruby-coloured transparent substance; it breaks readily with a clear conchoidal fracture, and is powerfully astringent. It forms a rose-tinted solution in water, and is soluble in cold alcohol.

It consists of a tannin and water; no other substance can be found in it. I cannot detect any difference in behaviour between this tannin and that of kinos belonging to the Ruby group. I have in this instance taken the opportunity of noting the tannin in its value as given by Löwenthal's method (as an equivalent of gallotannic acid), but have, in addition, stated the quantity as an absolute gravimetric percentage.

Its composition may thus be stated:—

Tannic acid	78·2
Ash	·8
Moisture	20·1
Insoluble impurities	·9
	100·0

By Löwenthal's process it gives 56·0 per cent. of tannic acid (as gallo-tannic acid equivalent). It is, in fact, a Ruby kino, the only apparent difference being that the kino of *Milletia megasperma* is not so readily soluble in hot water as the Ruby kinos of Eucalypts.

The occurrence of a kino in the Leguminosæ has not before been recorded from Australia; it is, however, not new in other parts of the world. Thus, the official kino is yielded by *Pterocarpus marsupium* of India and *P. erinaceus* of West Africa; the astringent exudation of *Butea frondosa* is well known, and similar substances are recorded from *Erythrina indica* and other leguminous plants.

It is of some scientific interest, but of no commercial importance; for the kino of *Milletia megasperma* could never compete with the practically identical and very abundant Ruby kinos of the Eucalypts.

[redacted]

is added to the acid solution, a precipitate is formed, as in the case of tragacanth.

From the above and other tests it was found that the gum possesses properties very similar to those of tragacanth. At the same time, the quantity of gum at my disposal is so very small that I have been unable to make practical tests of its value as a substitute for that well-known gum. It is proper to state that the gum of *Mezoneurum scortechinii* (or even of its allied species *brachycarpum)* can never be sufficiently abundant to form an article of commerce. It may be mentioned that tragacanth is also the product of a leguminous genus *(Astragalus)*, which is not, however, closely related to *Mezoneurum*.

The composition of this sample of Barrister Gum may be stated as follows :—

Soluble in cold water*	16·5
Soluble in acids ; insoluble in alkalies*	68·57
Moisture	10·95
Ash	3·98
	100·00

Both the kino and the gum were collected in the Richmond River district by Mr. W. Bäuerlen, Botanical Collector to the Technological Museum, and I have been helped in the examination of them by my laboratory-assistant, Mr. H. G. Smith.

* This gum appears to contain neither Arabin nor Metarabin. The soluble and insoluble constituents of tragacanth and some tragacanthoid gums are discussed in a paper by the author—"Sterculia Gum : its Similarities and Dissimilarities to Tragacanth" *(Pharm. Journ.* [3], xx., 381)—to which the reader is referred.

NOTES AND EXHIBITS.

A letter was read from Baron von Mueller asking that in the Abstract mention might be made of the fact that in his paper on Mr. Bradshaw's Plants from Prince Regent River, read at last meeting, he had pointed out that the genus *Osteocarpum* must be restored, and that *Babbagia* as a sub-genus should merge in it.

Mr. Froggatt exhibited specimens of the scales of five species of *Psylla*, and the perfect insects of three species, of which three are from Limestone Creek, Yass; the others from the neighbourhood of Sydney. Also, specimens of *Homopterous* galls belonging to the family *Brachyscelidæ*, growing somewhat like *Brachyscelis pharetrata*, but differing in the female gall being ribbed; from Yass, N.S.W.

[redacted]

WEDNESDAY, NOVEMBER 25TH, 1891.

The President, Professor Haswell, M.A., D.Sc., in the Chair.

DONATIONS.

"Agricultural Gazette of N.S.W." Vol. ii., Part 9 (September, 1891). *From the Director of Agriculture.*

"Royal Dublin Society—Scientific Transactions." Vol. iv., Series ii., Nos. 6-8 (1891); "Proceedings." n.s., Vol. vi., Part 10; Vol. vii., Parts 1 and 2 (1891). *From the Society.*

"Australian Museum—Advance Copy of Portion of Hand-List of Australian Mammals" (1891). By J. D. Ogilby. *From the Trustees.*

"Zoologischer Anzeiger." xiv. Jahrg., Nos. 373 and 374 (September and October, 1891). *From the Editor.*

"Annales de la Société Géologique de Belgique." Tome xviii., 1re Livraison (1891). *From the Society.*

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[redacted]

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PAPERS READ.

THE LAND MOLLUSCAN FAUNA OF BRITISH NEW GUINEA.

(Anatomical Supplement, continued from p. 115.)

By C. Hedley, F.L.S.

(Plates xxxviii.-xlii.)

Nanina hunsteini, Smith.

Jaw (pl. xxxviii., fig. 1) arched, smooth, with a slight median projection inferiorly, emarginate superiorly, ends rounded.

Radula (pl. xxxix., fig. 11) strap-shaped, three times as long as broad; formula 160 rows of 90 : 20 : 1 : 20 : 90; rows nearly straight, somewhat bracket-shaped; rachidian twice as long as broad, tapering to a single rather blunt cusp which just projects beyond the basal plate; laterals scarcely larger than the rachidian and of the same construction, angle of basal plate scarcely expanded, the more distant laterals grow slenderer and more inclined; two or three transition teeth intervene between the latter and the marginals, which are sinuate and bicuspidate. In the figure, the marginal teeth should be transferred from the right to the left of the centrals.

I lately hazarded a conjecture (Records Aus. Museum, Vol. i., p. 136) on the affinity of *N. hunsteini* to *N. sophiæ*, &c. The dentition here described does not support this view.

Genitalia (pl. xlii., fig. 39), penis sac long and cylindrical, with a globose sessile sac seated half way along it and another smaller

sac, to which the retractor muscle is affixed, at the summit; the spermatheca is at its apex boot-shaped, expanding after a constriction into a second globose sac, which communicates with the system by a short wide duct.

N. DIVISA, Forbes, var. INCLINATA, Pfr.

Jaw (pl. XL., fig. 20) smooth, wide, arched, with a deep beak-like projection inferiorly.

Radula (pl. XXXVIII., fig. 3) strap-shaped, three times as long as broad; formula 96 rows of 54 : 11 : 1 : 11 : 54; rachidian cusp large, ovate, considerably overlapping its basal plate, supplied at half its length with two accessory cusps; laterals one-third larger than the rachidian, inner accessory cusp lost, outer retained, outer angle of the basal plate alate; marginals unicuspidate, cusp in profile shaped like a rose-thorn, slender, inclined.

Genitalia (pl. XLII., fig. 38), penis sac large, dilated; spermatheca oval on a wide contorted duct.

This dentition bears out the relationship claimed on shell characters with western species. Compare Godwin-Austen's account of the anatomy of *M. rinkii* from the Nicobars (Land and F. W. Moll. of India, p. 12, pl. III.).

Helicarion musgravei, Hedley.

Jaw (pl. XXXVIII., fig. 9) short, wide, with a stout blunt median projection, ends emarginate.

Radula (pl. XLI., fig. 30) oval, three times as long as broad, stained brown anteriorly; formula 128 rows of 45 : 18 : 1 : 18 : 45; rachidian bearing a slender lanceolate median cusp surpassing its basal plate and two well developed accessory cusps; laterals long, narrow, with a slender median cusp, which becomes longer and more inclined as the ranks retreat, proximal accessory cusp rudimentary, distal one well developed; transitional teeth four or five, marginals much inclined, cusp bicapitate.

Cristigibba macgregori, Hedley.

Jaw (pl. XXXVIII., fig. 6) boomerang-shaped, smooth, ends truncated, no transverse ribs, inferior margin showing traces of denticulation, centre of the jaw closely longitudinally wrinkled.

Radula (pl. XXXIX., fig. 12) strap-shaped, twice as long as wide; formula 110 rows of 26 : 20 : 1 : 20 : 26; rachidian two-thirds the size of the immediate laterals, with a stout square-headed cusp extending along three-fourths of the narrow basal plate; laterals also square-headed, very slightly inclined, alate angle of basal plate scarcely produced; marginals tricuspid.

Chloritis leei, Cox.

Jaw (pl. XXXIX., fig. 15) arched, crossed by about eight stout flat-topped ribs, which denticulate either margin and are divided by narrow interstices, ends smooth, truncate.

Radula (pl. XXXIX., fig. 13) strap-shaped, three times as long as broad, rows nearly straight; formula 167 rows of 40 : 17 : 1 : 17 : 40; rachidian unicuspidate, stout, linguiform, two-thirds the length of

its basal plate, which is twice as long as broad and slightly expanded posteriorly; immediate laterals rather larger, similar in shape, not attaining the basal margin, basal plate briefly alate, distant laterals longer and slenderer; marginals developing a proximal accessory cusp, which assumes a sabre-like aspect and increases in size as the ranks retreat; a distal accessory cusp is also added.

Genitalia (pl. XL., fig. 23) remarkable for the extremely long flagellum, which arises from a double knob at the summit of the slender subcylindrical penis sac.

C. CHLORITOIDES, Pilsbry.

Jaw (pl. XXXIX., fig. 17) boomerang-shaped, crossed by nine elevated ribs, which denticulate both margins, ends smooth, rounded.

Radula (pl. XL., fig. 22) narrow, strap-shaped, three times as long as broad; formula 127 rows of 24 : 11 : 1 : 11 : 24; rachidian

[redacted]

[redacted]

in the marginals the main cusp is cleft at its summit and an accessory cusp appears at its distal base.

Genitalia (pl. XLI., fig. 27), penis sac large and ovoid; spermatheca small, cylindrical, without terminal dilatation.

GEOTROCHUS BRUMERIENSIS, Forbes.

Jaw (pl. XLI., fig. 31) boomerang-shaped, central half crossed by about nine weak ribs, which denticulate either margin, ends smooth, angled.

Radula (pl. XXXVIII., fig. 8) tongue-shaped, twice as long as broad; formula 110 rows of 40 : 7 : 1 : 7 : 40; otherwise as in *G. boyeri.*

Genitalia (pl. XL., fig. 21), penis sac small, conical; vas deferens long and contorted; spermatheca oval on a long peduncle.

G. LOUISIADENSIS, Forbes.

Jaw (pl. XXXVIII., fig. 2) boomerang-shaped, centre crossed by half-a-dozen weak ribs denticulating both margins, ends smooth, rounded.

Radula (pl. XL., fig 24) tongue-shaped, twice as long as broad; formula 142 rows of 45 : 9 : 1 : 9 : 45; rachidian smaller than the immediate laterals, square-headed, extending along three-fourths of the basal plate, whose anterior angles are scarcely expanded; laterals large, square-headed, alate angle of the basal plate scarcely expanded: marginals tricuspid.

Genitalia (pl. XL., fig. 19), penis sac large, dilated and contracting suddenly; spermatheca oval on a large peduncle.

G. ROLLSIANUS, Smith.

Jaw (pl. XXXVIII., fig. 10) thin, arcuate, central quarter crossed by seven very delicate ribs, ends smooth, rounded.

Radula (pl. XLI., fig. 29) strap-shaped; formula 154 rows of 45 : 10 : 1 : 10 : 45; rachidian two-thirds the size of the immediate laterals, reflection slightly tapering, terminating in a single square-headed cusp, which does not reach the basal margin;

laterals with a large square-headed cusp; after ten series a hook develops on the proximal side of the main cusp, which latter diminishes in size and divides into two or three cusps in the extreme marginals.

In the figure the marginal teeth should be transferred from the right to the left of the central.

G. WOODLARKIANUS, Souverbie.

Jaw (pl. XLI., fig. 28) low, boomerang-shaped, central third crossed by about half-a-dozen weak ribs with narrow interstices denticulating either margin, ends smooth, rounded.

Radula (pl. XLII., fig. 36) tongue-shaped, twice as long as broad; formula 130 rows of 42 : 9 : 1 : 9 : 42; rachidian about two-thirds the size of the immediate laterals, square-headed; laterals straight, square-headed, with the alate angle of the basal plate scarcely shown; marginals trifid.

Genitalia (pl. XLI., fig. 32) closely resembling those of *trobrian-* [redacted]

Radula (pl. xxxix., fig. 18), formula 104 rows of 33 : 6 : 1 : 6 : 33; rachidian cusp stout, ovate, two-thirds the size of the first lateral, extending along more than half of its basal plate; the cusp of the first lateral is large, oval, blunt, much inclined and equalling or surpassing the posterior margin of its basal plate, the succeeding laterals diminish in size; they are followed without any transition teeth by the marginals, which acquire a distal cusp in the same plane as the chief cusp and a falcate proximal cusp on a higher plane.

Genitalia (pl. xli., fig. 26), penis sac subcylindrical; spermatheca oval on a long peduncle.

Succinea simplex, Pfeiffer.

Jaw (pl. xlii., fig. 34) ribless, with a blunt median inferior projection, ends recurved.

Radula (pl. xlii., fig. 37) narrow, strap-shaped, three times as long as broad; formula 85 rows of 16 : 13 : 1 : 13 : 16; rachidian with basal plate twice as long as broad, slightly expanded posteriorly, reflection small, tricuspid, main cusp ovate, extending halfway along the basal plate, accessory cusps about half the size of the parent; laterals bicuspid, the proximal twice as long as the distal but shorter than the basal plate, which is emarginate on its posterior edge; one transition tooth is followed by minute marginals with trifid or quadrifid cusps.

Since writing the previous paper, several parts of the "Manual of Conchology" have appeared. Had I received them earlier, I should have profited by much additional information, and have replaced *Geotrochus* by *Papuina*, transferred *rehsei* and *beatricis* from *Hadra* to *Chloritis*, also *bevani*, *oxystoma* and *elisus* from *Geotrochus* to *Obba*, and reduced *tapparonei* to a synonym of *P. naso*, von Martens. I find that *S. gracilis*, Hutton, has several years' priority over *S. subula*, Pfr. (*ante*, pp. 98 and 557).

In alluding (*ante*, p. 100) to *S. simplex*, I expressed a doubt as to the correctness of the determination. Having requested Mr.

E. A. Smith, of the British Museum, to compare my Papuan specimens with Pfeiffer's types, I received from that gentleman the following courteous reply:—"The two specimens of *Succinea* from Mita, Milne Bay, are a trifle shorter than the types (3 specimens) of *S. simplex*, Pfr., and are more amber in colour, but they agree in the latter respect, and also in form, exactly with another series of specimens from Treasury and Shortland Islands, Solomon Group, which I identify as a form of *simplex*." Since the experiences of Mr. Brazier, Dr. Guppy, and myself agree in finding this mollusc in the taro gardens, it may perhaps be introduced with this vegetable from island to island.

I am also indebted to Mr. Smith for the information that my species *Helicina insularum* (*ante*, p. 113) is identical with *H. suprafasciata*, Sowerby (Conch. Icon. xix., HELICINA, pl. xxx., sp. 300), with whose types in the British Museum he has kindly compared my specimens. Sowerby's types were not collected, as stated, during the cruise of the "Curaçoa," but were received [redacted]

Archipelago. The chain of evidence is completed by the recognition (P.Z.S., *l.c.)* of Guppy's specimens as a variety of his *C. tristis* by Dr. Tapparone-Canefri, himself. I do not, however, understand why, if the preceding argument be correct, the learned conchologist of the British Museum failed to see Pfeiffer's species, of which he possessed the type, in the specimens labelled "Guadalcanar (MacGillivray)"; but the loss or displacement of a ticket has originated many such errors.

Other localities where this widespread and variable species has occurred to Mr. Brazier are—Rubiana, Solomons; Blanche Bay, New Britain; and Port Hunter, Duke of York Islands. After this review of specimens and descriptions, I have to plead guilty to adding a third name (*Leptopoma parvum; ante,* p. 111) to the synonymy of the species. The differences presented by the solitary shell I collected in Milne Bay from the figure and description published by Tapparone-Canefri, which alone I consulted, sink into insignificance after comparison with further specimens, figures and descriptions. Very close, if not identical with this species, must be the *C. novæ-hiberniæ,* Pfeiffer.

In my former article I dealt with the internal distribution of the mollusca of the province whose divisions may be briefly summed up as alpine, insular and northern or southern of the axis of the Owen Stanley chain of mountains. A few remarks on the external relations of this fauna have since suggested themselves. Wallace's line, so conspicuous a severance among the vertebrates, appears to be quite blotted out when the distribution of animals is regarded from a molluscan standpoint. No sharp break occurs between the Malayan fauna as exemplified in Borneo or the Philippines and in New Guinea. All the characteristic Malayan forms, *Atopos, Xesta, Helicarion, Microcystina, Trochomorpha, Obba, Chloritis, Cochlostyla, Pupina* and *Diplommatina,* are common to both regions. The Solomon Islands, Fiji, Samoa, &c., appear by the light of the Papuan shells to be inhabited by an eastern extension of this Malayan fauna, which has also over flowed into Queensland.

One of the most remarkable facts yielded by an analysis of the Australian land molluscan fauna is that the operculate snails are confined to a narrow strip of land along the Queensland coast. Proceeding southwards from Torres Straits, they diminish gradually till the last outpost of the invading army is reached about the Clarence River.* The sole apparent exception to this rule is *Truncatella*, which spreads to Tasmania and South Australia; but as this genus is strictly littoral and evidently migrates not by land but by sea, it cannot be considered as a disturbing factor in my generalisation. Contrasting the fauna of Queensland with the more typically Australian and probably archaic fauna of Tasmania, Victoria and Western Australia on the one side, and that of New Guinea on the other, it will be seen that this foreign aspect of the operculate genera *Pupina*, *Helicina* and *Diplommatina* is shared by the inoperculate forms of *Atopos*, *Hadra*, *Chloritis* and *Papuina*; *A. prismaticus* of Papua claiming affinity with *A. australis* of Queensland; *H. broadbenti* with *H. informis*; *C.* [redacted]

isthmus is still visible in any divergence between the faunas inhabiting the two areas.

Further to the westward, the coasts of Australia and New Guinea again converge, being separated by an arm of the Arafura Sea, which gradually shoals from a central depth of 40 fathoms, and stretches for about 150 miles between Cape Wessel in the northern territory and Cape Valsche on the opposite shore of Dutch New Guinea.

In the Transactions of the Royal Society of S. Australia, Vol. v., pp. 47-56, Professor Tate enumerates the land and freshwater mollusca of tropical S. Australia; it is remarkable that whereas a third of the landshells of Papua and a sixth of the landshells of Queensland are operculate, his census includes no operculate landshells whatever. Thus at the remote date when the ancestors of the present Queensland mollusc fauna migrated from New Guinea across the ancient isthmus that I suppose to have bridged Torres Straits, the Arafura Sea appears to have still presented an impenetrable barrier between the two countries. The former elevation of land in this region, if uniform from east to west, may therefore be calculated at more than seven and less than forty fathoms.

EXPLANATION OF PLATES.

Plate XXXVIII.

Fig. 1.—Jaw of *N. hunsteini*. Magnified.

Fig. 2.—Jaw of *G. louisiadensis*. Magnified.

Fig. 3.—Two rows of seven teeth from the centre, and of the eighteenth to the twenty-second from the margin, of the radula of *N. divisa*, var. *inclinata*. Much magnified.

Fig. 4.—Two rows of thirteen teeth from the centre, and of the twenty-fifth to the thirtieth from the margin, of the radula of *M. sappho*. Much magnified.

Fig. 5.—Jaw of *G. trobriandensis*. Magnified.

EXPLANATION OF PLATES *(continued).*

Fig. 6.—Jaw of *C. macgregori.* Magnified.

Fig. 7.—Jaw of *M. sappho.* Magnified.

Fig. 8.—Two rows of seven teeth from the centre, and of the forty-second to the forty-fifth from the margin, of the radula of *G. brumeriensis.* Much magnified.

Fig. 9.—Jaw of *H. musgravei.* Magnified.

Fig. 10.—Jaw of *G. rollsianus.* Magnified.

PLATE XXXIX.

Fig. 11.—Two rows of eleven teeth from the centre, and of the twenty-second to the twenty-sixth from the margin, of the radula of *N. hunsteini.* Much magnified.

Fig. 12.—Two rows of eleven teeth from the centre, and of the twenty-seventh to the thirty-first from the margin, of the radula of *C. macgregori.* Much magnified.

Fig. 13.—Two rows of thirteen teeth from the centre, and of the twenty-

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EXPLANATION OF PLATES *(continued).*

Fig. 23.—Genital system of *C. leei.*

Fig. 24.—Two rows of nine teeth from the centre, and of the twenty-third to the twenty-seventh from the margin, of the radula of *G. louisiadensis.* Much magnified.

PLATE XLI.

Fig. 25.—Jaw of *G. boyeri.* Magnified.

Fig. 26.—Genital system of *G. boyeri.*

Fig. 27.—Genital system of *H. broadbenti.*

Fig. 28.—Jaw of *G. woodlarkianus.* Magnified.

Fig. 29.—Two rows of nine teeth from the centre, and of the forty-eighth to the fifty-first from the margin, of the radula of *G. rollsianus.* Much magnified.

Fig. 30.—Two rows of eleven teeth from the centre, and of the twenty-second to the twenty-sixth from the margin, of the radula of *H. musgravei.* Much magnified.

Fig. 31.—Jaw of *G. brumeriensis.* Magnified.

Fig. 32.—Genital system of *G. woodlarkianus.*

PLATE XLII.

Fig. 33.—Genital system of *G. trobriandensis.*

Fig. 34.—Jaw of *S. simplex.* Magnified.

Fig. 35.—Two rows of eleven teeth from the centre, and of the thirty-fourth to the thirty-eighth from the margin, of the radula of *H. broadbenti.* Much magnified.

Fig. 36.—Two rows of eleven teeth from the centre, and of the seventeenth to the twentieth from the margin, of the radula of *G. woodlarkianus.* Much magnified.

Fig. 37.—Two rows of eleven teeth from the centre, and of the nineteenth to the twenty-second from the margin, of the radula of *S. simplex.* Much magnified.

Fig. 38.—Lower portion of the genital system of *N. divisa,* var. *inclinata.*

Fig. 39.—Genital system of *N. hunsteini.*

ERRATA.

Pl. III.—Fig. 5 is incorrectly described as "of natural size"; it should be "× 1½."

Page 71, line 29—*for* * *read* †.

Page 80, line 11—*to description add* Nature, Dec., 1890. p. 115.

Page 80, line 34—*after* I found in company *add* with.

Page 85, line 29—for *Helix Goldei* read *Helix Goldiei.*

Page 86, line 4—*after* goldiei, Brazier, *add* 1885.

Page 93—*to habitats add* Douglas River (Bevan).

Page 99, line 15—*to anatomy add* Proc. Ac. N.S. Phil., 1875, pl. XV., fig. 8, and pl. XVI., fig. 1.

Page 99, line 21—for TORNATELLINA TERESTRIS read TORNATELLINA TERRESTRIS.

Page 107, line 24—*for* antepenultimate *read* penultimate.

Page 108—*to* 94 *add* †.

Page 111, line 8—*for* penultimate whorls *read* penultimate whorl.

[redacted]

ON A FORM OF WOMERAH, OR "THROWING-STICK," PRESUMED TO BE UNDESCRIBED.

By R. Etheridge, Junr., &c.
(Palæontologist to the Australian Museum, and Geological Survey of N. S. Wales.)

I am indebted to Mrs. John Storer for the opportunity of describing a *Womerah*, or "Throwing-stick," different to any I had previously seen figured or described.

The late Governor Eyre described the Throwing-stick in general, or *ngā-wŏ-ōak*, as he terms it in one of the Aboriginal dialects, as from "twenty to twenty-six inches in length, and is of a very similar character throughout the continent, varying a little in width or shape according to the fashion of particular districts. It consists of a piece of hardwood, broad about the middle, flattened and sometimes hollowed on the inside, and tapering to either extremity; at the point the tooth of a kangaroo is tied and gummed on, turning downwards like a hook; the opposite end has a lump of pitch with a flint set in it, moulded round so as to form a knob, which prevents the hand from slipping whilst it is being used, or it is wound round with string made of the fur of the opossum for the same purpose. In either case it is held by the lower part in the palm of the hand, clasped firmly by the three lower fingers, with its upper part resting between the fore-finger and the next; the head of the spear, in which is a small hole, is fitted to the kangaroo tooth, and then coming down between the forefinger and thumb, is firmly grasped for throwing."* It is manifest that this can only be accepted as a very general description.

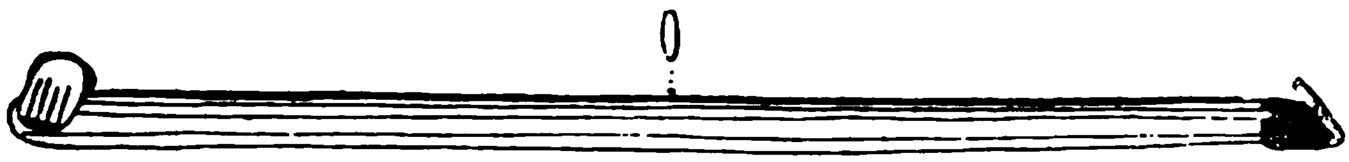
* Journ. Exped. Discovery into Central Australia, 1845, ii., p. 307.

Eyre figured four different kinds of womerah, varying in their width, sectional outline, and shape, but all with the mounted kangaroo tooth at the proximal end, and a lump of gum, or gum and a stone, at the distal extremity. The width, and in consequence the shape, differs in all four types, but in the narrowest there is a flattened surface on which the spear could, if necessary, lie.

The late Mr. R. B. Smyth figured* five types from Victoria and two from West Australia. The Victorian womerahs, all but one, belong to the shield-shaped pattern, the exception being a mere stick. The distal end is either mounted with a tooth, as described by Eyre, or carved into the form of a hook, whilst the proximal extremity is devoid of any check to the hand at all. The stick-like womerah is a very rude and rough weapon. Smyth stated that the womerah was known to the Yarra Tribe as *Kur-reek*, or *Gur-reek;* by the Goulburn (Victoria) Tribe called *Murri-wun;* or at Lake Tyers in Gippsland *Merri-wun;* on the [redacted]

the greatest width five inches. The weight varies from seven and three-quarter ounces to ten ounces."*

The womerah from Agate Creek, a tributary of the Gilbert River, and the subject of the present notice, was obtained by Dr. John Storer, and its genuineness thereby attested. It is two feet



ten and a half inches in length, one and a quarter inches in breadth, but only three-eighths of an inch in thickness, wholly in the same plane, flat at the sides, and sharp and ridge-like above and below, with hardly any perceptible decrease in breadth towards either end. The weight is eight ounces, and the weapon is quite rigid and well polished. The hinder end is obliquely cut off, and against it is fitted a well made peg of hard dark wood, attached by black gum-cement and sinews, and taking the place of the kangaroo tooth. At the proximal or fore end, against each of the flat sides of the womerah, is affixed, with gum-cement, portions of the shell of *Melo diadema*. The peg is one and three-quarter inches long, and the portion of shell two inches.

This weapon is a very peculiar type of womerah, owing to its rigid lath-like form and the absence of any flattened transverse surface similar to several of those figured by Eyre and Smyth. The pieces of shell at the fore end take the place of the lump of gum, or gum and stone, in the more southern types. The sides of the throwing-stick are quite plain and uncarved, but smooth and well polished. The substitution of shell for gum alone at the fore end is evidently not of common occurrence.

On showing the Agate Creek womerah to my Colleague Mr. John Brazier, he was at once struck with its resemblance to throwing-sticks obtained at Cape Grenville, North-East Australia, during the progress of the "Chevert Expedition;" and referred me for other examples to the Macleay Museum. Therein I saw,

* Aborigines of Victoria, 1878, i., p. 338.

[redacted]

through the kindness of the Curator, Mr. George Masters, a series of four from Cape Grenville, the Herbert River, and the Batavia River, Gulf of Carpentaria. The Herbert River weapon is exactly the counterpart of that from Agate Creek, but is one inch longer; that from Cape Grenville swells out in breadth in the centre, being two and seven-eighths wide, graduating off towards the fore end so as to accommodate itself to the hand of the thrower. At the same time, it is equally as thin as the womerah from Agate Creek, but the shells are set at right angles to the shaft, instead of obliquely. The length is two feet two inches. The Batavia River womerah is precisely similar to the last. It is, however, two inches longer and three inches at the widest point. The hand-grasp is gummed to afford a better hold to the thrower, the same part in the womerah from Cape Grenville being bound with a reed also. These throwing-sticks form a well-marked type, differing entirely from those used in the south and south-west, and, like the large, irregularly oval, light wood, painted shields, seem to be chiefly confined to the north-east of the continent

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NOTES AND EXHIBITS.

Mr. Etheridge exhibited the womerah described in his paper.

Rev. J. Milne Curran exhibited a good specimen of "knotted schist" from the aureole of altered rock surrounding the intrusive granite at Bathurst; also a specimen of the auriferous lode-stuff from Pambula.

Mr. C. W. Darley exhibited a collection of shells dredged up from the sandspit off Darling Point in front of Rushcutters Bay. The dredge "Sydney," Mr. H. Orr, master, has been removing this bank, and in doing so has lifted an immense quantity and variety of shells, of which a few are now exhibited. The question is how was this large sand-bank formed; and did the shells live on it, for they show little or no signs of abrasion, as would probably be the case if they had drifted any distance? If they did, have they all been killed by impurities in the water, for none are found living? The sand-bank extends from the N.W. corner of Darling Point a distance of at least 1200 feet towards Garden Island. There is only 12 feet of water at the end and 6 feet at about 600 feet out. As deep as has been dredged, say for 28 feet at least, the bank is all pure sand.

Mr. Fred. Turner exhibited specimens of *Telopea oreades*, F.v.M. (narrow-leaved form), the Victorian Waratah, collected at the Fitzroy Falls, N.S.W., the most northern habitat yet recorded for the plant; said to be very rare. Also three fungus-smitten grasses from the interior: *Eriochloa punctata*, Hamilt., *Panicum Mitchelli*, Benth., (two valuable pasture grasses; in the case of the second of these the first occasion on which he had seen fungoid growth on it), and *Aristida ramosa*, R.Br., one of the "three awned spear grasses," a noxious plant. To the presence in fodder of parasitic fungi such as these, the fact that many sheep died so mysteriously at times, was, Mr. Turner thought, sometimes possibly attributable.

Mr. Fletcher exhibited specimens of a fly (fam. *Phytomyzidae*) the larvæ of which in great numbers have infested several composites —cinerarias, thistles, but more particularly the marguerites and summer chrysanthemums—in Sir William Macleay's garden adjoining, during the last two months; so numerous have they been that many of the plants have been quite spoilt for horticultural purposes. Also, for the Hon. W. R. Campbell, M.L.C., specimens of crickets (*Gryllus servillei*, Sauss.) which, in the Macintyre River District during March and April last before the frosts set in, appeared in myriads, doing considerable damage to the sweet potato and lucerne crops, and injuring even blankets.

Mr. Froggatt exhibited and read a short note on the life-history of a dipterous insect belonging to the genus *Syrphus*. The specimens exhibited were bred from some pale green larvæ, found upon Eucalyptus leaves which were covered with the larvæ of *Psyllidæ*. While keeping the *Psylla* in a damp box, some very minute grubs were noticed to be crawling about among the [redacted]

IN MEMORIAM

Sir William Macleay, Kt., F.L.S., M.L.C.

Born at Caithness, N.B., June 13th, 1820,

Died at Sydney, N.S.W., December 7th, 1891.

Note.—Out of respect to the memory of Sir WILLIAM MACLEAY, the December Monthly Meeting was not held.—ED.

WEDNESDAY, JANUARY 27TH, 1892.

ANNUAL GENERAL MEETING.

The President, Professor Haswell, M.A., D.Sc., in the Chair.

The minutes of the last Annual Meeting were read and confirmed.

PRESIDENT'S ADDRESS.

The past year is one which, I have little doubt, will always be looked back upon as one of the most eventful in the history of this Society. During its course we have lost by death two of our most valued members, one of whom had long been in many ways the mainstay of the Society, and we have been placed by a

[redacted]

was the author of several important contributions to Australian geology, partly published in the Annual Reports of the Department of Mines, partly in the Proceedings of the Royal Society of N.S. Wales, partly in those of this Society. His duties took him frequently away from Sydney to various parts of the country; but when in town he was a regular attendant at the meetings of this Society, of which he was President in the years 1884 and 1885. His contributions to the Proceedings of this Society were the following:—

(1) Notes on a collection of Geological specimens collected by William Macleay, Esq., F.L.S., from the Coasts of New Guinea, Cape Yorke, and the neighbouring Islands. [Vol. I., p. 113.]

(2) Notes on the Abercrombie Caves. [Vol. IV., p. 460.]

(3) Notes on some Customs of the Aborigines of the Albert District, New South Wales. [Vol. VIII., p. 436.]

(4) Presidential Address, 1884. [Vol. VIII., p. 535.]

(5) Presidential Address, 1885. [Vol. IX., p. 1207.]

Kenrick Harold Bennett, who died on June 30th, was one of that unfortunately not too numerous school of educated bush-naturalists, who spending their lives in the country, engaged in pastoral and other pursuits, are yet sufficiently in touch with societies such as ours, to permit of their observations being recorded and utilised. Mr. Bennett's observations were chiefly on birds—their habits, their nesting, and their eggs; and he contributed a number of new facts in connection with these subjects, many embodied in Mr. A. J. North's "Catalogue of Birds' Nests and Eggs," published by the Australian Museum; but he at one time devoted much attention to native weapons, implements, and utensils, in which he was well versed. Several papers from his pen have been published in the "Proceedings" of this Society.

More recently we have to deplore also the death of Sir William Macleay, to whom this Society owes, if not its very existence, at least its prosperous maintenance for a good many years, and to whom Australian Science is indebted for many benefits. William

Macleay was born in Scotland, but, coming to New South Wales as a very young man, he became the most patriotic of colonists, and spent all the rest of his life in this country, never once leaving it except on the occasion of his expedition to New Guinea. During all the earlier part of his life in this colony he was engaged in pastoral pursuits on a large scale, being concerned in very extensive stations in the district of the Murrumbidgee. He also during these earlier years took an active share in the political life of the country. But during the last 15 or 20 years of his life, though he never ceased to take a keen interest in all public matters and remained a member of the Upper House, and though until comparatively recently he retained the ownership of large stations, yet he gave a very large share of his time to the cultivation of Natural Science, and left his stations to his managers—very rarely indeed leaving Sydney even for a single day. With remarkable single-mindedness and still more remarkable absence of ostentation, he set himself to advance the study of the Natural History Sciences in this colony; and this in a manner which— [redacted]

Now I think I may say that Sir William Macleay contributed to the progress of science to a greater or less extent, not in one or two only, but in all of these ways. As an original investigator his name is best known as an entomologist and ichthyologist. In the former field he worked diligently for many years, devoting with the greatest regularity the morning hours of every day to his collections. The results of his work are embodied in a large number of papers contributed to the Transactions of the long defunct Entomological Society of New South Wales; and to the Proceedings of this Society. In these papers very many new species of Australian Coleoptera of a number of families are described. Ichthyology was taken up as a special study at a somewhat later stage—the first contributions to this subject being the papers descriptive of the Fishes of the "Chevert" Expedition, in which the late Dr. H. G. Alleyne collaborated with him; these were published in 1876. In subsequent years numerous papers on this subject appeared, the most important of which were those entitled "Descriptive Catalogue of the Fishes of Australia," subsequently issued in a separate form, and constituting a most useful and convenient handbook to the study of Australian Fishes. In these entomological and ichthyological studies Sir William Macleay had pretty constantly in view the economic bearing of his subject, as is witnessed by his not infrequent notes on noxious insects in the Entomological Society's Proceedings, and in many observations contained in his ichthyological papers. His knowledge of the latter subject was brought specially to bear on the subject of the fisheries of the colony in the work of the Royal Commission appointed in 1880 to enquire into the subject of the fisheries—a Commission of which he was elected chairman. The practical outcome of the Report of this Royal Commission was the Fisheries Act of 1881, still in force, under which the Commissioners of Fisheries hold their appointment. The practical side of his character was also shown in the efforts which he made to promote and support various enterprises for securing to the metropolis a more adequate supply of fish.

Sir William Macleay's work as an investigator, though it was extensive and useful, was none of it of an epoch-making character, and it is mainly in the other ways to which I have directed attention that he deserved well of the republic of science. Our distinguished friend Baron von Mueller's phrase "the Mæcenas of Australian natural science" is scarcely an exaggeration; and, though he has had no Horace to enshrine his name in immortal verse, yet his benefits are of such a kind as to ensure that his name will be handed down to future generations.

Sir William Macleay's services to natural science in this colony as a collector of specimens which have proved, and are likely still more to prove, of value in adding to faunistic knowledge are well known to all of you. His most imposing enterprise in this direction was the expedition which he undertook in the year 1875 to the Northern Queensland Coasts, to the Islands of Torres Straits and New Guinea.

In a paper which he read before this Society on his return in [redacted]

short time at my disposal, seems wonderful, and which affords undoubted proof of the industry and zeal of my staff of collectors. For it must be remembered that, though the full time of my intended absence from Sydney has expired, the actual time available for the purposes of the voyage was much less than I calculated on. The 'Chevert,' though a good, dry, and comfortable ship, was unable to sail against the wind, and it was so constantly against us during a great part of the expedition that I do not think we had more than sixty days for collecting during the five months' cruize."

Though this expedition was in some measure disappointing—the plans formed before starting not having been fully carried out—yet the result in the acquisition of new and rare objects of natural history of all kinds were very rich. Most of the new forms have since been described, though there are still some groups awaiting investigation. But for many years Macleay was constantly adding to his collection from sources nearer home—having skilled men collecting for him in various parts of Australia, and having for years a taxidermist and articulator, as well as his curator, working in his private Museum. The result was the accumulation of a large collection, embracing all departments of Zoology, which was always accessible to those desiring to make use of it for purposes of research.

This general collection, together with his unrivalled collection of Australian and other insects, partly inherited from William Sharpe Macleay, partly accumulated by himself, he presented, as you are aware, two years ago to the University, stipulating only that a suitable building should be provided, and that the collection should be accessible to members of the Linnean Society of New South Wales and to students of natural science generally, as well as to students of the University. Together with the collections he presented the sum of £6000, the interest of which serves for the salary of the curator. A large, though, unfortunately, not very handsome, building was erected by the Government at the request of the Senate of the University, and the collections were transferred thither in the course of the year before last. The

control of the Macleay Museum has been vested by the Senate in a Committee consisting of the Professor of Geology—Prof. David—and myself as Professor of Biology, and we are fortunate in having an able and zealous curator in Mr. George Masters.

As this collection and its fate must be of special interest to you on the present occasion, I propose to give some brief account of it, the building in which it is housed, and of the way in which it is proposed to utilise it.

The collection is, as might be expected, richest in Australian objects; but many specimens from various parts of the South Pacific region were obtained from various sources, and a considerable number of specimens from other Zoological regions were purchased from dealers. To begin with the anthropological and ethnological collections: there are over 200 crania of aboriginal Australians, and natives of New Guinea and the South Sea Islands, besides six entire skeletons of natives of Torres Straits. There are many hundreds of specimens of weapons and utensils

The Mollusca, though not nearly so numerous as the Insects, are yet a very numerous collection, which Mr. Masters estimates at not less than 50,000.

Of the numbers of the other Invertebrata, no estimate has been formed; but there are many thousands of specimens of Worms, Echinoderms, Coelenterates, and Sponges.

Besides these zoological specimens, there is also a considerable, though much less important, collection of geological specimens from various sources.

The building in which these Macleay collections are now housed at the University, contains a single spacious hall, 200ft. long by 76ft. wide. Around this runs a gallery, 13ft. wide at the sides and 26ft. at the ends. The space below the gallery is divided by partitions into a series of bays, eleven on each side, each bay having a large window. The presence of the gallery, divided, like the space below it, by a number of partitions, and capable of being completely closed off from the body of the hall, will enable us very conveniently to effect that division of the Museum into general or public collections and special or scientific collections which is now so generally aimed at. In this gallery will be placed such portions of the collections as are not required in the series on exhibition below for the benefit of students and other visitors: these will comprise the unmounted skins of Birds and Mammals and all the duplicate specimens of all kinds, together with the cabinets of Insects. These special collections will be open for study, with permission of the Committee, to any student of zoology wishing to investigate any particular group.

One of the special features of the Macleay Museum ought, in my opinion, to be a good, well-displayed series illustrative of the Australian fauna in all its branches. For this there is ample material in the Macleay collection, which would require but little supplementing to render the series as complete as need be. This will occupy a considerable part of the available space. While this faunistic collection will form an important feature of the Museum and will always be the most interesting to the

general visitor, a University Museum would fall very far short of its purpose did it contain nothing more. For the benefit of the general student of science, there must be a series of specimens and preparations, accompanied by models and explained by diagrams, illustrative of the morphology and life-history of all the various main groups, both of plants and animals, together with small collections illustrative of various special biological phenomena, such as variation, mimicry, and the like. Such a series as this aims at enabling the student to see for himself as many as possible of the most characteristic features in the external form, internal structure, the embryology, conditions of life, and the like, of the leading types of animal and plant life. With the slender resources at present at our disposal, only very slow progress can be made in this important department of the Museum; but a commencement at least has been made, and when the necessary cases are constructed, there will soon be a good educational series for the use of the student of science. Another section of the Museum has been set apart for the geological collections, comprising

[redacted]

He spent, moreover, a large sum of money in the purchase of books for the Society's library, and, when these were unfortunately destroyed by fire on the burning down in 1882 of the Garden Palace, in which the Society was then lodged, he immediately set to work anew to form the fine collection of scientific works constituting the greater part of our library as it now stands.

By Sir William Macleay's generosity several workers in various branches of science have been enabled to carry on their researches here or in the former home of the Society in Phillip-street, without requiring to expend their time and energy on bread-winning work. Dr. R. von Lendenfeld was for two years working in this way under the auspices of the Society, and the results of his work have seen the light in a large number of papers treating chiefly of the Sponges and Hydrozoa published in our Proceedings. Succeeding Dr. von Lendenfeld, Dr. Oscar Katz for several years worked in the Linnean laboratory, the outcome of his researches being a series of contributions to Bacteriology which have been published in the Proceedings. Mr. Skuse has also been engaged under Sir William Macleay's auspices in entomological work, and has thus been enabled to make a very good beginning towards filling in a previously blank space in our knowledge of the Australian fauna by means of his numerous descriptions of Dipterous Insects of various families.

And, finally, I must not omit to mention that by his appointment by Sir William Macleay to the post of Director and Librarian of this Society, Mr. J. J. Fletcher has secured sufficient leisure in the intervals when his numerous secretarial and editorial duties have been less pressing, to carry on zoological work, the results of which are before us in his valuable papers on the Australian Earthworms, the Batrachia, and other subjects.

Not only did Sir William Macleay present this Society with this commodious building, and the greater part of its library, he also paid all salaries, defrayed the expense of the greater number of the plates, and gave it most generous and much-needed assistance in many other ways. So that it might be able to

sustain a heavy loss. For though the intrinsic value of the scientific work done can only be finally decided upon by a tribunal that does not belong either to the present time or to any particular society or particular country, yet the sympathy and co-operation of those with whom they come in immediate contact must always be of importance to investigators in science, as to workers in any sphere of life.

The choice of subjects for investigation which the devotee of biological science resident in Australia has before him is a very large one. To the botanical worker there are very numerous tempting fields promising rich harvests. For instance among the Algæ the abundant *Siphoneæ* that live on the tropical parts of the coast are only known as regards their general form; and their structure and especially their development offer a promising field of investigation. The same holds good of the Red Seaweeds; for though many have been described by Agardh, Sonder, Harvey and others, yet in the case of many—one might say most of the genera that seem to be specially characteristic of

in the Proteaceæ is the leaves. While comparatively uniform and highly specialised as regards the structure of their flowers, the members of this characteristic order are, as you are aware, distinguished by a great amount of variety in the form and texture of the leaves: it is the foliage, in fact, that is protean much more than the flower; and the remarkable circumstance connected with this variability in the leaves is that widely divergent forms of leaf are to be found in members of the order otherwise closely allied. How are such extreme differences to be explained? It seems probable, *a priori*, that a thorough-going investigation would reveal, in some instances at least, a definite usefulness to the plant of the particular form of leaf to be observed; and perhaps this order is one through which general results on the meaning of various forms of leaves might favourably be attained. There is a peculiarity in the *minute structure* of the leaves of certain *Proteaceæ* (species of *Banksia*) which they share with the Oleander, that has not been fully accounted for. This consists in the presence, on the under surface, of numerous very minute apertures bordered with hairs, leading into cavities in the substance of the leaf—the stomata being entirely or almost entirely confined to these cavities, instead of being dotted over the general surface. Whether, as has been conjectured, the object of this arrangement is to prevent the stomata from being clogged by excessive moisture, transpiration thus being seriously interfered with, remains to be determined: it seems unlikely, taking into account the circumstances under which the *Banksias* now live, that any such special modification to provide against excess of moisture is required.

The zoologist has before him in Australia a very extensive field. Leaving out of account such departments of his subject as can equally well be dealt with in other parts of the world, there are many themes for dealing with which he has special advantages owing to his position in Australia. Let me briefly direct your attention to a few of these.

The *Protozoa* are so cosmopolitan in their distribution that they do not display very marked geographical features. Most of the

Rhizopoda and *Infusoria* which we find in the sea or in fresh water here are nearly related to, though very often clearly distinguishable from, northern forms. Some peculiar forms have, however, been observed, and I think that a student of any of the groups of Australian *Infusoria* or *Rhizopoda* need not despair of finding something new of importance and interest. Among the *Sporozoa* a species of *Myxobolus (Myxosporidia)* is common as a parasite of certain frogs, and affords a good opportunity for the investigation of the unknown life-history of that group. Sponges are so abundant and varied that the working out of the embryology which is thoroughly known in so few cases, ought to be a fruitful subject of study.

The Australian lower groups of worms have only been examined as regards certain small and restricted groups—that which has hitherto received most attention being that of the Land-Planarians. The *Rhabdocœla* and the marine *Polycladidæ* and *Tricladidæ* are, with the exception of a few superficially described (by Stimpson and Schmarda), entirely untouched; and the same holds good of [redacted]

Baird and others. Neither *Echiurus* nor *Sternaspis* have as yet been observed in Australian seas.

In the great group of the Mollusca one of the most promising entirely new fields for research is the development of the Pearly Nautilus, for though this survivor from remote times is only occasionally found on the Australian coast, yet operations against it would best be conducted with Australia as a base. The development of the Paper Nautilus (*Argonauta*) is also an important desideratum in Zoological science; but unhappily the visits of the Argonauts are not to be reckoned on. The development of *Spirula*, on the other hand, ought not to be beyond the reach of well-directed efforts.

Among the *Brachiopoda*, *Waldheimia flavescens* is somewhat abundant at some points in Port Jackson, and whoever takes it in hand may contribute something of importance to our somewhat scanty knowledge of the development of this class.

There is much to be done in describing species in the various orders of *Crustacea* and *Insecta*, while among the *Arachnida* whole sections remain untouched.

The Australian *Tunicata* offer a promising field for research. Professor W. A. Herdman has taken in hand the description of a number of them, and we hope soon to have his account of them; but there is much in this class that can only be adequately done on the spot with abundance of fresh material. The observer in Sydney ought, I may here remark, to be peculiarly favourably situated for working out the development of that most interesting of all Tunicates—*Appendicularia*—since both *Appendicularia* proper and *Fritillaria* occur in abundance in Port Jackson right up to the wharves of Sydney.

The investigation of the development of some of the peculiar Australian forms of fishes would be of immense importance and interest. I may mention the Port Jackson shark (*Heterodontus* or *Cestracion*), *Trygonorhina*, *Pristiophorus*, and *Callorhynchus* as particularly tempting. The development of *Ceratodus* is still a desideratum; but I trust we shall hear something about it before long.

There are so many peculiar forms of Australian *Batrachia* that a life-time might be spent in working out the development of some of the more interesting forms. *Pseudophryne*, with its limited number of large ova, undergoing the early stages of their development out of the water, and that remarkable genus *Chelydobatrachus* may be mentioned as particularly likely to yield important results.

Among the reptiles the development of the crocodiles is now, since the publication of the results of Clarke's and Voeltzkow's observations, no longer *terra incognita;* but the peculiar fresh-water tortoises of Australia would, doubtless, well repay investigation in this direction, and so, no doubt, would many of the genera of *Lacertilia* and *Ophidia*.

Of the birds, the anatomy of some of the peculiar families, such as the scrub birds, the lyre birds, and others, is only known (and that imperfectly) as regards the skeleton. The most interesting of the birds, as regards the development, is, of course, the emu, some of the stages of which I have had the opportunity of

[redacted]

and to Science in general, a memorial volume, consisting of original scientific contributions by members of the Society and others, be published, as suggested by the President in his Address, and that the Council of the Society be asked to make all necessary arrangements."

The motion was carried unanimously.

The President, in the unavoidable absence of the Hon. Treasurer, made a short statement as to the finances of the Society, showing that, on December 31st last, there was a credit balance in the bank of £86 8s.

The following gentlemen were elected

OFFICE-BEARERS AND COUNCIL FOR 1892.

President:

Professor W. A. Haswell, M.A., D.Sc.

Vice-Presidents:

James C. Cox, M.D., F.L.S.
Rev. W. Woolls, Ph.D., F.L.S.
Henry Deane, M.A., M.I.C.E.

Honorary Secretaries:

P. N. Trebeck, J.P.
Thomas Dixson, M.B., Ch.M.

Honorary Treasurer:

The Hon. James Norton, LL.D., M.L.C.

Director and Librarian:

J. J. Fletcher, M.A., B.Sc.

Council:

John Brazier, F.L.S.
N. A. Cobb, Ph.D.
Professor T. W. E. David, B.A., F.G.S.
Robert Etheridge, Jun.
Cecil W. Darley, C.E.
J. H. Maiden, F.L.S., F.C.S.
E. G. W. Palmer.
Percival R. Pedley.
Thomas Whitelegge, F.R.M.S.

[redacted]

INDEX TO VOL. VI.

(SECOND SERIES.)

NAMES IN ITALICS ARE SYNONYMS.

PAGE

Abispa australiana 15
Abraxas 631
Absyrtes magnificaria 653
Abutilon leucopetalum 460
Acacia conspersa... ... 468, 469
decurrens 587, 610, 621, [654, 680
flavescens 468
hemignosta 468
kelleri 468
linaroides 468
lycopodifolia 467
pallida 469
penninervis 138
prominens ... 572, 577
sentis 33
sericata 468
stipuligera 468
suberosa 469
tetragonophylla... ... 138
translucens 467
Acidalia primaria 642
Ackama muelleri 138
Actinotus helianthi 44
Adansonia gregorii 133
Adelium 543
aequale 539
alpicola 536
angulatum ... 538, 540
augurale 537
auratum 538
brevicorne 536
calosomoides ... 536, 537
cisteloides ... 539, 540
inconspicuum 536
lindense... 538, 539, 540
neophyta ... 535, 536
parallelum 540
porcatum 537
pustulosum ... 534, 535
Adelium similatum 535
tropicum 537
victoriae 535
Æchalia 545
Agarista albamedia 301
cæruleotincta 303
donovani ... 302, 303
latinus 302
semyron 304
simplex 301
tropica 302, 303
Agathia distributa 296
iodioides 296
lætata 297
lycænaria 297
Alastor 13
Albizzia canescens 469
Alchornea ilicifolia 166
Alsophila 718
Amelora 582, 583, 646
amblopa ... 647, 649
arotraea ... 647, 651
australis ... 647, 649
catacris 647, 650
demistis... ... 647, 648
goniota 647
leucaniata ... 647, 651
milvaria ... 647, 650
sparsularia ... 647, 648
Ammophila suspiciosa 14
Amphioxus lanceolatus 155
Anas elapsa 455
Ancylus australicus ... 563, 575
Andropogon montanus 477
procerus 477
sericeus *var.* polystacha 477
triticeus 477
Aneitea graeffei 595
Angophora 253

PAGE

Angophora cordifolia 253
intermedia, 61, 253, 254, [255, 257, 307
lanceolata, 253, 254, 255, [257, 307
subvelutina... .. 253
woodsiana ... 253, 254
Anisomeles salvifolia 474
Anoglypta launcestonensis, 22, 25, 26
Anoplognathus boisduvali . . 494
brevicollis ... 493
macleayi .. 495
odewahni 494, 495, [496
rugosus. 494
Anteia canescens... 300
Antheræa banksii 293
eucalypti 293
helenae 293
intermedia 293
loranthi 292
Anthistiria membranacea ... 477
Anthopora pulchra 16
Apalochrus cinctus 531
Apl... lus ... 149

PAGE

Astur 438
Azura bisecta 279
Atalaya hemiglauca 463
Atopos 693, 694
australis 551, 694
prismaticus 694
Babbagia 465, 682
Badistes 321, 322
gulosa 324, 326
Balea australis 570
Banksia dentata 471
sp. 719
Barringtonia acutangula ... 470
Baza 123, 438
Bellardiella 560
minor ... 102, 116
Bipalium kewense 44
Biziura 449
exhumata 455
Blepegenes aruspex 533
equestris 533
nitidus 533
Boarmia acaciaria 617
alienaria 617
attacta 624

PAGE

Bridelia tomentosa 463
Bronteus 317
Buechnera browniana 474
Bulbine bulbosa 135
Bulimus *beddomei* 97
bidwilli 557
dufresni 19, 22, 24, 25, 26
hobsoni 567
macconnelli 570
macleayi... ... 97, 694
mastersi... 21
scotti 568
tasmanicus ... 21, 25
Bulinus 563
beddomei 562
brazieri 575
fusiformis 563
gibbosus 575
gracilentus 562
kreffti 562
mammillatus 562
pectorosus 562
productus 562
proteus 562, 575
pyramidatus 563
reevei *var.* obesus ... 562
var. truncatus ... 562
Burtonia subulata 465
Butea frondosa 680
Byblis liniflora 458
Bythinia tryoni 564
Callicarpa pedunculata 166
Callicoma serratifolia 138
Calligenia melitaula 279
pilcheri 279
Callimorpha selenaea 653
Calliscapterus 430
Callorhynchus 721
Calochromus 528
Calophyllum inophyllum ... 134
Calycia isseliana 97
Calycothrix microphylla ... 469
Camaena 325
Canarium australasicum ... 463
Canavallia obtusifolia 467
Cardiophorus bicolor 516
elisus 516
eucalypti 516
victoriensis ... 516
Carenidium kreuslerae 432
lacustre 432
Carenum *arenarium* 431
bonellii 430

PAGE

Carenum brisbanense 431
campestre 430
castelnaui 431
decorum 431
dispar 429
distinctum 430
habilis 428
ignotum ... 427, 428
inconspicuum 428
kingi 431
murrumbidgense ... 431
occultum 431
odewahni 430
ordinatum 430
scaritioides 428
scitulum 430
sexpunctatum ... 431
subcostatum 431
submetallicum ... 431
viridipenne 430
westwoodi 430
Carphibis 442, 443
Cartonema spicatum 475
Carya australis 470
Casbia irrorata 636
rectaria 636
Cassia concinna 467
mimosoides 467
sp. 136
Casuarina suberosa 704
Celmus 313
Centranthera hispida 474
Ceratodus 236, 721
Ceroplatus mastersi 249
Cestracion 721
Chaeropus 722
Chalcolampra 542
Chalcophaps 121
Charopa duncani 574
funerea 553, 574
iuloidea 553
mussoni 574
nautiloides 574
omicron 553
paradoxa 574
texta 79, 116
Cheilanthes tenuifolia 478
vellea 478
Cheiragra macleayi 482
Chelyconus worcesteri 276
Chelydobatrachus 722
Chemerina cuneifera 663
Chenopis 449

PAGE

Chiroleptes australis 168, 264, 270
platycephalus 125, 265, [269, 270, 271, 272
Chlenias ... 582, 583, 647, 652, 660, [662, 673
arietaria ... 662, 663
auctaria... 664
banksiaria ... 662, 664
beggaria 660
belidearia 659
carburaria ... 662, 666
crambaria 663
fucata 658
galearia 674
indecuata 664
melanoxysta ... 662, 663
porphyrinaria 660
seminigra ... 662, 666
umbraticaria ... 662, 664
vittalugera 651
zonaea 662, 665
Chloraema 343
dujardinii 338, 342, 351
edwardsii 338
Chloritis 693, 694
ar... 555

PAGE

Cocos nucifera 133
Coeliaxis australis ... 569, 570
Commelina ensifolia 475
Conosara 584, 660
castanea 660
Conulus maino 75, 115
russelli 101
starkei ... 75, 76, 101, 115
subrugosa 75
turriculatus 553
Conus worcesteri... 276
Coppingeria 332, 336, 337, 340, 341, [344, 345, 347, 348, 349, 351
longisetosa 329, 332, [351, 352, 355, 356
Corbicula minor 564
nepeanensis 575
ovalina 564
prolongata 575
Corchorus allenii 462
echinatus 462
elderi. 462
hirsutus .. . 462
Cosymbia 583, 591
clarissa ... 591, 592
penthearia ... 591, 592

PAGE
Ctenodrilus 347
Cyathus 167
Cycas media 475
Cyclothorax eyrensis 480
fortis 481
lophoides 481
obsoletus 481
peryphoides ... 480
punctipennis 480, 481
Cyclotropis papuensis 108
Cyclotus belfordi... ... 109, 116
horridus 80, 108, 116
kowaldi ... 109, 116
levis 692
novæ-hibernæ 693
poirieri... 108
tristis ... 108, 692, 693
Cynanchum floribundum ... 473
pedunculatum ... 473
Cyphaspis... 319
bowningensis ... 312
Cyphon ... 517, 520, 521, 522, 523
pallidulus .. 521, 522
variabilis 521
Cypraea tigris 8
Cystopelta 29
petterdi ... 24, 26
Dacelo 444
Dædrosis victoriae 533
Daphnandra micrantha 284
Darala asciscens 288
expansa 286
linearis 289
magnifica... ... 286, 289
rosea 291
rubriscripta 291
scortea 290
stygiana 288
succinea 290, 291
Dascillus 518
Deilinia ... 584, 600, 633, 634
cremnias ... 635, 638
eccentritis 635
impressaria ... 635, 636
lithodora ... 634, 637
ochthadia ... 635, 639
oenias 635, 637
rectaria 635, 636
Dendrobium speciosum 125
Dendrocygna validipennis ... 455
Desmodium biarticulatum ... 467
parvifolium ... 466
Diastictis 583, 586

PAGE
Diastictis australiaria 587
margaritis ... 587, 588
Dicliptera glabra 474
Didiscus hemicarpus 470
Dinoria picta 543
Dinornis 453
queenslandiae 455
Dioscorea sativa... 475
Dipeltis 143, 155
cirrhatus 156
minor 156
typicus 157
Diphucephala aurulenta ... 482
elegans 481
Diplommatina 693, 694
egregia 561
minus 561
scalatella ... 561
symmetrica 107, 116
Diplomorpha coxi 571
Diplosis sp. 249
Diprotodon 160, 162, 163, 164, 165
Discalma 585, 590
normata 590
Discoelius sp. 14
Distichostemon phyllopterus ... 463
Dolichandrone heterophylla ... 474
Dorylaimus 143, 146, 147, 148, 149,
[150, 151, 152, 153
latus... 150
Dromaius 447, 451
gracilipes 445, 447, 448,
[455, 456
novæ-hollandiæ 446, 447,
[448
patricius 446, 447, 448,
[455
Dromœolus interioris 502
lugubris 503
Dromornis 453
australis 455
Drosera indica 458
petiolaris 458
Drymoptila 585, 670
temenitis 670
Echinocarpus australis ... 140, 141
Echiurus 721
Ectropis 583, 624, 625
argalea 626, 627
camelaria ... 626, 630
exsuperata 626, 627, 628
fractaria 612, 626, 629
isombra... ... 626, 627

PAGE

Ectropis pristis 626
subtinctaria ... 626, 628
Ectrosia leporina 477
Ellopia cumularia 673
Emex australis 578
Enchytraeus 347
Endotricha crobulus 305
dispergens 306
pyrosalis 306
Enoplus cirrhatus 155
Epicompsa 584, 585
xanthocrossa 585
Epione incaria 673
Equisetum 167
Eremophila 373
mitchelli ... 278, 279
Eriachne obtusa 476
squarrosa 476
Erianthus irritans 477
Eriocaulon setaceum 476
Eriochloa punctata 703
Erythrauchen 121
Erythrina indica... 680
vespertilio 467
Esacus 442
Eucalyptus 49, 53, 54, 55, 57, 58, 59,

PAGE

Eucalyptus cordata ... 51, 64
cornuta, 50, 391, 392, 401
corymbosa . . 8, 49, 50, 51, 65, 254, 390, 392, 402, 411, 412, 415, 416
corynocalyx 391, 392, [397, 400
crebra 53
cunninghami .. 51
dichromophloia . . 53
diversifolia .. 51
doratoxylon ... 64
elongata 51
erythrocorys ... 64
eugenioides . 56, 59
eximia, 58, 392, 411, 416
exserta 53
fabrorum 404
fasciculosa 390, 391, 392, [396, 397
ferruginea 53
fibrosa 53
ficifolia 65
foelscheana... . 65
gamophylla 64, 65

PAGE

Eucalyptus macrocarpa... ... 64
maculata, 56, 58, 59, 255, 256, 389, 390, 391, 392, 408, 409, 417, 418, 419, 422
maideni 391, 402, 406, [407
marginata 50
media 51
melanophloia 53, 64
melissiodora ... 53
melliodora ... 391, 392, [396, 400
micrantha 50
microcorys ... 389, 390, [391, 392, 411, 422
microphylla ... 51
microtheca 53
myrtifolia 51
obliqua ... 49, 50, 51
oblonga 50
obtusifolia 51
odontocarpa 53, 64
odorata 391, 392, 395
oldfieldii 65
ovata 51
pachyphylla 53, 65
pallens 51
paniculata ... 49, 50, 51, 60, 61, 63, 391, 396, 577
var. angustifolia... 397
patellaris 53
pellata 58
perfoliata ... 56, 64
persicifolia 50
phœnicea 53
pilularis, 49, 50, 51, 60, 64
piperita 49, 50, 51, 59
platyphylla... ... 53
polyanthema 56, 63
polycarpa 53
populifolia 394
populnea 53
pruinosa 64
ptychocarpa, 53, 65, 469
pulverulenta 51, 64
pulvigera 51
punctata ... 50, 58, 60, [392, 409
purpurascens ... 51
pyriformis 65
radiata 51

PAGE

Eucalyptus resinifera, 49, 50, 58, 425
reticulata 51
rigida 51
risdoni 56
robusta 49, 50, 59, 412
rostrata ...53, 61, 391, [402, 403, 406, 408
saligna, 49, 50, 58, 59, 60
santalifolia ... 56, 65
scabra 51
semicorticata ... 53
setosa ... 64, 65
siderophloia ... 56
sideroxylon... 63, 391, [398, 399, 400
signata 53
stellulata ... 50, 60
stenophylla... ... 51
stricta 51
stuartiana ... 64, 391, [402, 405
tectifica 53
tereticornis... 49, 50, 53, [59, 60, 61
terminalis ... 53, 392, [411, 415, 469
tesselaris ...53, 65, 392, [411, 417
tetragona ... 64, 65
tetrodonta ... 53, 64, 469
todtiana 65
trachyphloia, 53, 392, 426
tuberculata... ... 51
umbellata 51
variegata 53
viminalis 50, 56, 58, 60, 64, 135, 391, 401, 402, 404, 405, 406
var. multiflora ... 405
virgata 50
Eucryphia moorei 138
Eulimella laxa 247
moniliforme 247
Euowenia 160, 163, 164, 165
grata ... 160, 161, 162
robusta ... 160, 165
Euphorbia schizolepis 463
Euschemon rafflesiæ 30
var. albo-ornatus 30
Eutoma newmani 431
punctulatum 431
Exocarpos latifolia 471
Favosites fibrosa... 193

PAGE

Ficus macrophylla 682
 platypoda 463
Fidonia amitaria 673
 atomaria 673
Flabelligera affinis 347
Flagellaria indica 476
Flemingia lineata 467
 pauciflora 467
Fodina gloriosa 304
Fœniculum vulgare 135
Forbesia 312, 313
 euryoeps ... 312, 313
Frenchia casuarinæ 704
Fritillaria 721
Fruticola coriaria 325
Fuirena umbellata 476
Fulica 439
 prior 439, 454
Fusanus spicatus 137
Galaxias monacha 325
Gallinula 439
 peralata 440, 454, 456
 strenuipes 440, 441, 454
 tenebrosa ... 440, 441
Gasteruption sp. 13
Gastrina 584, 667
[redacted]

PAGE

Geotrochus *hunsteini* 86
 lacteolatus 94
 louisiadensis 69, 90, 92,
 [689, 695, 696, 697
 macgillivrayi 88, 694
 meditatus 93
 mendana 94
 millicentæ 90
 oxystoma 86, 116, 691
 pelechystoma ... 87
 ridibundus 93
 rollsianus ... 70, 90, 91,
 [689, 696, 697
 siculus 94
 tapparonei ... 88, 116
 taumantias 92
 var. singulatus ... 93
 taylorianus ... 69, 87, 88
 var. katauensis ... 87
 var. roseolabiatus 88
 var. strabo ... 87
 var. yulensis ... 87
 thomsoni 91
 tomasinellianus ... 93
 var. alpha ... 93
 var. azonatus . 93
[redacted]

PAGE
Grewia mollis 140
polygama 462
Gryllus servillei 704
Gymnodinium spirale 167
Gynopteryx ada 645
Hadra 694
beatricis 84, 691
blomfieldi... 556
var. warroensis ... 556
broadbenti 69, 85, 688, 694, [696, 697
coriaria 326
derbyi 566
fraseri 556
gerrardi 84
gulosa 321, 322, 323, 326, 327
nixoni 84
incei 556
var. aureedensis ... 556
var. bayensis 556
var. lessoni 556
informis 694
liverpoolensis 574
monacha 327
morosa 324, 327
oscarensis... 565
pachystyla 557
var. daemeli 557
rehsei ... 69, 80, 84, 691
rockhamptonensis ... 555
var. pallida 556
scotti 326
Hakea arborescens 471
saligna 138
Halia australiaria 587
Haliaetus 123, 124, 438
leucogaster ... 123, 437
Haliastur 123, 124, 438
Harpalus 543
Hectomanes crocea 283
fusca 283
simulans 283
Hedleya 569
macleayi 568
Heleioporus albopunctatus ... 271
pictus 271, 272, 273
Helicarion 77, 693
fumosa 24
hyalinus 24
milligani 24
musgravei ...77, 84, 116, [687, 694, 697
robustus 24, 248, 552

PAGE
Helicarion verreauxi ... 24, 26
visi 76, 116
Helichrysum lucidum 472
Helicina 694
congener 112
coxeni 69, 111
dentoni 112
diversicolor 561
fischeriana 112
gladstonensis 562
insularum 69, 113, 116, 692
jana 694
leucostoma 115
var. muruensis ... 113
var. rosselensis ... 114
var. sinus 113, 114, 116
var. trobriandensis .. 113
louisiadensis 114
maino 115, 116
multicoronata ... 115, 116
novo-guineensis... ... 112
solitaria... 112
stanleyi... ... 112, 114
suprafasciata 692
woodlarkensis ... 114, 116
Heliotropium tenuifolium ... 474
Helix achilles 71
bevani 85
coriaria 321, 322, 323, 324, [325, 326
derbyi 566
ericetorum 576
goldiei 85
grayi 321, 323
gulosa 321, 322, 323, 324, [325, 326, 327
jervisensis... 321
lessoni ...321, 322, 325, 326
mastersi ...321, 322, 324, 325
monacha ... 322, 324, 325, [326, 327
morosa 321, 322, 324, 325, [326, 327
oscarensis 565
scotti 321, 322, 324, 325, 326
Helodes 517, 518
adelaidæ ... 521, 522
cinctus ... 517, 518, 519
frater 520
lindensis 522
minutus... ... 518, 519
montivagans 519
olliffi ...517, 518, 519, 520

PAGE

Helodes ovensensis 520
pictus 520, 521
princeps ... 517, 523
spilotus 521
Hemerophila excursaria ... 598
luxaria 609
mundifera 598
silicaria 598
vestita 609
Hemodia lythrifolia 474
Hepialus daphnandræ 284
hilaris 284
scotti 284, 285
Heterodontus 721
Heteronyx ... 486, 490, 491
alpicola .. 487, 489
anceps 490
auricomus 490
baldiensis 485
brevicornis 492
consanguineus 490, 491
deceptor 489
diversiceps 492
froggatti 489
frontalis 491
gracilipes 488
granum 492

PAGE

Hyla aurea 264, 272
cærulea ... 44, 264, 265, 272
citropus 212, 264
dentata 274
ewingii 274
gracilenta ... 44, 263, 264
peronii ... 44, 265, 272, 273
phyllochroa 263
rubella 272
Hyperolia marmorata 272
Hypochroma aurantiacea ... 297
diffundens ... 298
disconata 629
muscosaria ... 298
nigraria 629
velutinata 668
Hypoestes floribunda 474
moschata .. . 474
Hyposidra 583, 588
australis 588
janiaria 588
Hypsiprymnodon 722
Icerya purchasi 126
Idiodes 585, 642
apicata 642, 643
inspirata 643
[illegible] 643

PAGE

Lacon caliginosus ... 505, 507
carinulatus 506
divaricatus ... 506, 509
duplex ... 506, 508, 509
eucalypti ... 507, 508, 509
humilis 509
lacrymosus ... 505, 509
lindensis 504, 509
murrayensis ... 504, 509
sculptus 504
variabilis 504
variolus 504
victoriae ... 507, 508, 509
Lagyra agrealesaria 588
diffusata 588
infusata 588
Laius cinctus 531
eyrensis 531
femoralis 531
pretiosus 532
rufovirens 532
Larentia exprimataria 604
Larina strangei 564
Lecanomerus flavocinctus 479, 480
major ... 479, 480
striatus 479
Leptopoma gianelli 110
luteum 110
nitidum 110
parvum 111, 116, 693, 694
venustulum... ... 111
vitreum 70, 110, 694
Leptospermum 606, 624
Leschenaultia agrostophylla ... 472
Leucosarcia 121
Libythea 27, 28, 29
myrrha... ... 27, 28, 29
nicevillei 28
rohini 29
Licinoma 543
pallipes 542
Limax lævis 553
Limnea lessoni 562, 575
var. angasi 562
Limnodynastes dorsalis 271, 272, 273
ornatus... ... 271
peronii 272
salminii 44, 265, 272
tasmaniensis ... 271, [272, 274
Liodes leucaniata 651
Liparetrus 484
alpicola 483

PAGE

Liparetrus apser 483
brunneipennis ... 484
depressus 484
ferrugineus ... 484, 485
iridipennis 483
spretus 482
sylvicola 483
Lithophaps 121
ulnaris 122, 123, 454
Livistona sp. 475
Lobivanellus 442
sp. 439, 454
Lomatia fraseri 139
Lomographa 584, 633
isocyma ... 633, 634
spodina 633
Lophiocephalus ... 338, 341, 342
Lophodes 583, 620, 621
sinistraria 620
Lophoictinia 438
Lopholaimus 121
antarcticus ... 121
Loranthus acacioides 472
sp. 293
Loxosoma 330
Lucerna gulosa 324
Ludwigia parviflora 470
Luffa aegyptiaca 248
graveolens 472
Luperus 549
flavipes 549
Lycaon expulsus 503
Lycus ochraceus 526
Lygodium sp. 478, 721
Macaria frontaria 587
gratularia 587
infixaria 587
panagraria 587
porrectaria 587
remotaria 587
Macropygia 121
Manihot aipi 578
Manisuris granularis 476
Masicera pachytyli 249
Megacarpaea polyandra 463
Megachile 16
Megaloprepia 121
Melaleuca leucadendron ... 16
Melania balonnensis 575
denisonensis 563
queenslandica 563
tatei 563
Melanodes 585, 621

PAGE
Melanodes anthracitaria ... 622
Melo diadema 701
Melobasis azureipennis 497
beltanensis 499
monticola 496
nervosa 497
obscurella 498
rotundicollis 498
simplex 498
superba 498
verna 497
viridi-obscura ... 498
Menura 121, 438, 444
Metapteryx bifrons 453, 455, 456
Metriorhynchus 524, 525
clientulus ... 525
erythropterus 524, [525, 526, 527
gigas 524
inquinulum .. 525
lætus 527
lugubris ... 526
marginatus ... 528
monticola ... 526
occidentalis ... 526
rufipennis 524, 527
semicostatus 525

PAGE
Monocrepidius australasiae ... 513
baldiensis 514, 515
brucki 512
cerdo 510
fictus 513
frontalis 510, 512, 515
jakeli ... 512, 513
macleayi 512, 515
nitidulus ... 512
ovensensis 514, 515
rectangulus ... 511
ruficollis 509, 511, [515
Monoctenia digglesaria 300
Monohammus frenchi 543
Monolepta benallæ 549
croceicollis 549
froggatti 549
modesta 549
Monstera deliciosa 248
Myoporum sp. 41
Myristicivora 121
Myxobolus 720
Nanina bruijni 74
cairni 73
citrina 71
doriæ . 71

PAGE
Nototherium 160, 162, 163, 164
victoriæ 163
Nyctemera amica ... 280, 281
annulata 281
crescens ... 280, 281
secundiana ... 280, 281
tertiana ... 280, 281
Nymphaea coerulea 457
gigantea 458
stellata ... 457, 458
tetragona 458
Nyroca robusta 455
sp. 455
Obba 693
bevani 691
elisus 691
oxystoma 691
Ochthephila albertisi ... 79, 116
Odontopera australis 649
Odynerus bicolor 14
concolor 14
Œdematophora cacaalis... ... 306
Omphalotropis brazieri, 80, 101, 116
protracta 101, 116
Onyx 143, 146, 148, 149, 151, 153
perfectus ...147, 152, 153, 154
Ophideres saliminia 249
Ophiodes disjungens 304
parcemaula 304
Osbeckia australiana 470
Osteocarpum 465, 682
Osteodes 583, 589
procurata 589
Ostrea edulis *var.* angasi ... 307
Owenia 159, 160
Owenia vernicosa 459
Oxytes flyensis 71, 115
hercules 70, 115
Pachtylus australis 249
Palæobia longestriata 17
Palæopelargus 441
nobilis 442, 455, 456
Palmeria scandens 166
Panaethia matutinata 632
Panagra ferritinctaria 589
jucundaria 640
rupicolor 591
sparsularia 648
undiferaria 640
Panda falconari *var.* maconelli 554
Pandanus 108
Pandion 123
Panicum brevifolium 476

PAGE
Panicum indicum 476
majusculum 476
minutum 476
mitchelli 703
Papuina 691
bidwilli 557
conscendens 557
fucata 557
naso 691, 694
Paralaea 584, 670
promacha 671
Paropsis 545
latipes 546
lutea 545
maculata 545
marmorea 545
regularis 547
sublimbata 547
waterhousei 545
yilgarnensis 545
Partula occidentalis ... 98, 116
similaris 97
woodlarkiana 98
Paryphanta 69
fumosa 24
milligani 24
Paspalum scrobiculatum ... 476
Passa latifasciata 668
Patula fabrefacta ... 80, 81
Pedinogyra cunninghami ... 554
var. minor ... 555
Pelicanus 444, 445
conspicillatus ... 445
proavus 444, 455, 456
Pelopœus lætus 14
Penthea vermicularia 544
Peragalea 722
Perga affinis 307
dorsalis 307
Peridinium 167
Peripatus leuckarti ... 167, 577
novæ-zealandiæ ... 577
Persoonia chamæpeuce 166
falcata 471
Petalostigma quadriloculare ... 462
Petraia 193
Phæton 312, 313
Phalacrocorax 438
Phallaria conductaria 643
inductaria 643
Phallus 167
Phascolomys ...235, 237, 238, 246
angustidens 243, 244

PAGE

Phascolomys curvirostris ... 236
gigas ... 237, 239
krefftii 236
latifrons 236, 237, 240, [241, 246
medius 238
mitchelli 239, 241, 242, [243, 244, 245, 246
parvus ... 236, 243
platyrhinus 237, 238, 239, 240, 241, 242, 243, 244, 245, 246
thomsoni 239
Phascolonus 237, 239, 258, 260, 262
Phillipsastræa currani 193
verneuilii ... 193
Philoscaphus tuberculatus ... 430
Phylloglossum 718
Phylloxera vastatrix 166
Phytomyza sp. 704
Pimelea punicea 470
sanguinea 470
Pison marginatus 14
spinolæ 14
Pitta 444
Placostylus hobsoni 567

PAGE

Pomatia monacha ... 325, 326
scotti 325
Pompilius aurifrons 14
Porina kershawi 282
Porphyrio 439
mackintoshi, 440, 454, 456
reperta ... 440, 454
Portulaca australis 464
digyna 464
Praxis corvus 622
illapsa 668
Pristiophorus 721
Proboloptera . .. 584, 641
clelia 642
embolias 641
Proetus 312, 313, 319
archiaci 319
ascanius .. 312, 316, 317
australis ...315, 316, 319, 320
bohemicus 313
bowningensis, 312, 313, 314, [315, 319
corycœus 317
decorus ... 315, 317, 319
euryceps... 315
latifrons 315

[redacted]

PAGE
Ptilotus gracilis 465
spicatus... 464
Puccinia 249
Pultenaea sp. 650, 667
Pupa anodonta 558
artensis 99
hyalina 99
kingi 558
macdonnelli 99
nacca 99
nitens 99
pacifica 558, 575
pedicula, 76, 99, 101, 558, 575, 694
recondita 99
samoensis 99
Pupina 693, 694
costata 559
coxi 559, 560
gibba 107, 116
meridionalis 560
ovalis 106, 116
petterdi 560
planilabris 560
strangei 561
ventrorsa 560
wilcoxi 560
Pupinella angasi 103, 104
angasi 104
brazieræ 70, 91, 103, 105
var. aignanensis .. 105
crossei... 105
forbesi... 103
grandis ... 69, 103
var. minor 104
intermedia 104
leucostoma 104
louisiadensis 104
macgregori ... 102, 103
minor 102, 103
moulinsiana ... 103, 104
rosseliana 105
smithi 103, 104
tapparonei 106, 116, 691
typica 105
Pycnospora hedysaroides ... 467
Pythia scarabæus 101
Rhamphicarpa 473
macrosiphonia ... 473
Rhinodia 584, 640
rostraria 640
Rhopæa 493
heterodactyla 493
Rhynchonella pleurodon ... 194

PAGE
Rhynchonella sp. 229
Rhytida capillacea 574
globosa 69, 80, 116
lampra 23, 26
splendidula 554
var. strangeoides ... 554
walkeri 553
Ricinocarpus 458
Roeperia 458
cleomoides 458
Rotala verticillaris 470
Rottboellia formosa 477
Salsola kali 465
Santalum cygnorum 137
Sarcostemma australe 472
Scardamia... ... ... 584, 639
chrysolina 640
Sceparnodon 164, 237, 238, 258, [260, 262
ramsayi 259
Schizæa 718
Scioglyptis 583, 593
hemeropa ... 593, 594
lithinopa 593
Scirtes helmsi 524
hemisphæricus 524
Sclerocyphon 522
maculatus .. 523
Scodiona milvaria 650
Scolia coronata 14
Scotosia fractata 615
Sebastiania chamaelea 462
Sechium edule 168
Segmentina victoriae 563
Seirotrana... 540
dispar 542
integricolle 540
monticola 541
parallela 540, 541, 542
simplex ... 540, 542
Selenia apamaria 587
Selidosema 582, 583, 586, 591, 593, [594, 622, 673
acaciaria 596, 617, 618
adelphodes ... 596, 611
aganopa 597, 610, 612
agoraea ... 598, 608
amphiclina ... 596, 599
argoplaca ... 595, 615
bitaeniaria ... 596, 616
canescaria ... 597, 603
capnota ... 596, 605
cheleuta .. 596, 598

PAGE

Selidosema cognata 597, 606, 607
- curtaria ... 597, 602
- despicata ... 595, 612
- destinataria 596, 613
- epistictis ... 596, 619
- eremias ... 596, 600
- euboliaria ... 595, 615
- excursaria 597, 609, 629
- exprimataria 596, 604
- externaria ... 597, 602
- *hemipteraria* ... 609
- illustraria ... 596, 618
- leptodesma ... 597, 606
- leucoplecta ... 596, 607
- luxaria ... 597, 609
- lyciaria ... 597, 604
- pallidiscaria 597, 612
- *penthearia* 592
- perfectaria ... 597, 614
- silicaria ... 597, 598
- suasaria ... 597, 601
- thermaea ... 598, 600
- zascia ... 596, 613

Serpentulus gulosus 324
Sesbania grandiflora 466
Seseli harveyanum ... 135

PAGE

Stegania allogata.. 640
Stenocarpus cunninghami ... 471
Stenogyra *artensis* 99
- *diaphanea* 99
- gracilis 557, 691, 694
- gyrata 99
- *juncea* 98
- *novemgyrata*... ... 99
- *octonoides* 98
- *panayensis* 99
- *procera* 98
- *souverbiana* 99
- subula 98, 557, 691
- *tuckeri* 98, 101, 557
- *upolensis* 98
- *walli* 98

Sterculia acuminata 578
- diversifolia 134

Sternaspis... 721
Sthenomerus 164
Stibaroma... ... 584, 669, 670
- melanotoxa 669

Stictonetta nævosa 8
Strigoptera 499, 500
- australis ... 501, 502
- frenchi 499, 500, 502

PAGE

Teara fimbriata 285
togata 285
Telephorus fusicornis 529
galeatus 529
nobilitatus 530
pauxillus 528
pusio.. 528
vibex 530
victoriensis ... 528, 530
Telopea oreades 166, 703
Tephrina *adustaria* 592
impressaria 636
normata 590
procurata 589
Tephrosia *absorpta* 624
bispinaria ... 599, 673
curtaria 602
despicata 612
disperdita 609
disposita 628
euboliaria 615
excursaria 609
exesaria 674
exportaria 609
externaria 602
fractaria 629
gratularia 601
indirecta 613
integraria 624
mactaria 624
perfectaria 614
phibalapteraria ... 609
propinquaria .. 601
subtinctaria 628
vagaria 613
Terebella 347
Terminalia microcarpa 470
Tetracis cachexiata 673
Thalaina 585, 652
angulosa ... 652, 655
australiaria 653
clara 653, 654
inscripta ... 652, 655
lienaea 653
principaria 655
punctilinea 653
selenaea 653
Thalassia annula... 78, 116, 694
delta 553
moretonensis 552
pudibunda 552
rustica... ... 78, 552
Themeda arguens 477

PAGE

Thynnus brenchleyi 15
conspicuus ... 15, 16
pulchralis 15
smithii 16
sp. 15
Thysanotus chrysantherus ... 475
Tigridoptera 585, 631
mariana 631
matutinata 631, 632
rotundata... 631, 632
Tipula sp.... 577
Tmesipteris 718
Tornatellina eucharis 558
terrestris 99
Trianthema pilosa 464
Tribonyx 439, 440
effluxus ... 439, 454
mortieri 440
Triodia procera 478
Tristania psidioides 470
Triumfetta appendiculat ... 461
bradshawii ... 460, 462
fabreana 461
johnstoni 461
plumigera 461
winneckeana ... 461
Trochomorpha lomonti 78
nigrans 79
var. cornea ... 79
planorbis ... 78
Trophonia... ... ... 336, 347
capensis 334
cincta... 347
eruca 339
horstii 347
monilifer 344
plumosa ... 336, 347
xanthotricha... ... 338
Truncatella *cerea* 100
ceylanica ... 100, 694
conspicua 100
nitida 100
semicostata 100
sp. 694
teres 100
valida ... 100, 694
vitiacea 100
vitiana 100
Trygonorhina 721
Tylenchus... 149
Unio australis 564, 575
depressus *var.* angasi ... 564
var. mutabilis... 564

	PAGE
Unio novæ-hollandiæ ...	... 564
Uraria cylindracea ...	... 467
Uroaetus	... 123
audax	... 123
brachialis ...	123, 454
Vedalia cardinalis ...	126, 166
Verbena officinalis ...	... 137
Verticordia cunninghami	... 469
Vitis acetosa	... 471
trifolia	... 471
Vivipara essingtonensis...	... 564
sublineata ...	... 564
Voluta magnifica... ...	... 307
Vanga delineata	... 667
Waldheimia flavescens ...	... 721
Waltheria indica... ...	... 460
Weinmannia paniculosa...	... 138
Wistaria	... 679
Xanthorrhœa	... 16
Xenomusa metallica ...	... 299
monoda ...	... 300
Xenorhynchus	442, 443
nanus... ...	... 456
Xerotes brownii	... 475
media	... 475
Xesta	... 693
Xiphogonium	... 313
Xylocopa æstuans ...	... 16
muscaria ...	... 16
Zanclopteryx	... 674
permensata	... 674
Zerene devinctaria ...	... 674
Zermizinga indocilisaria	... 623
Zygomaturus ...160, 163, 164, 165	

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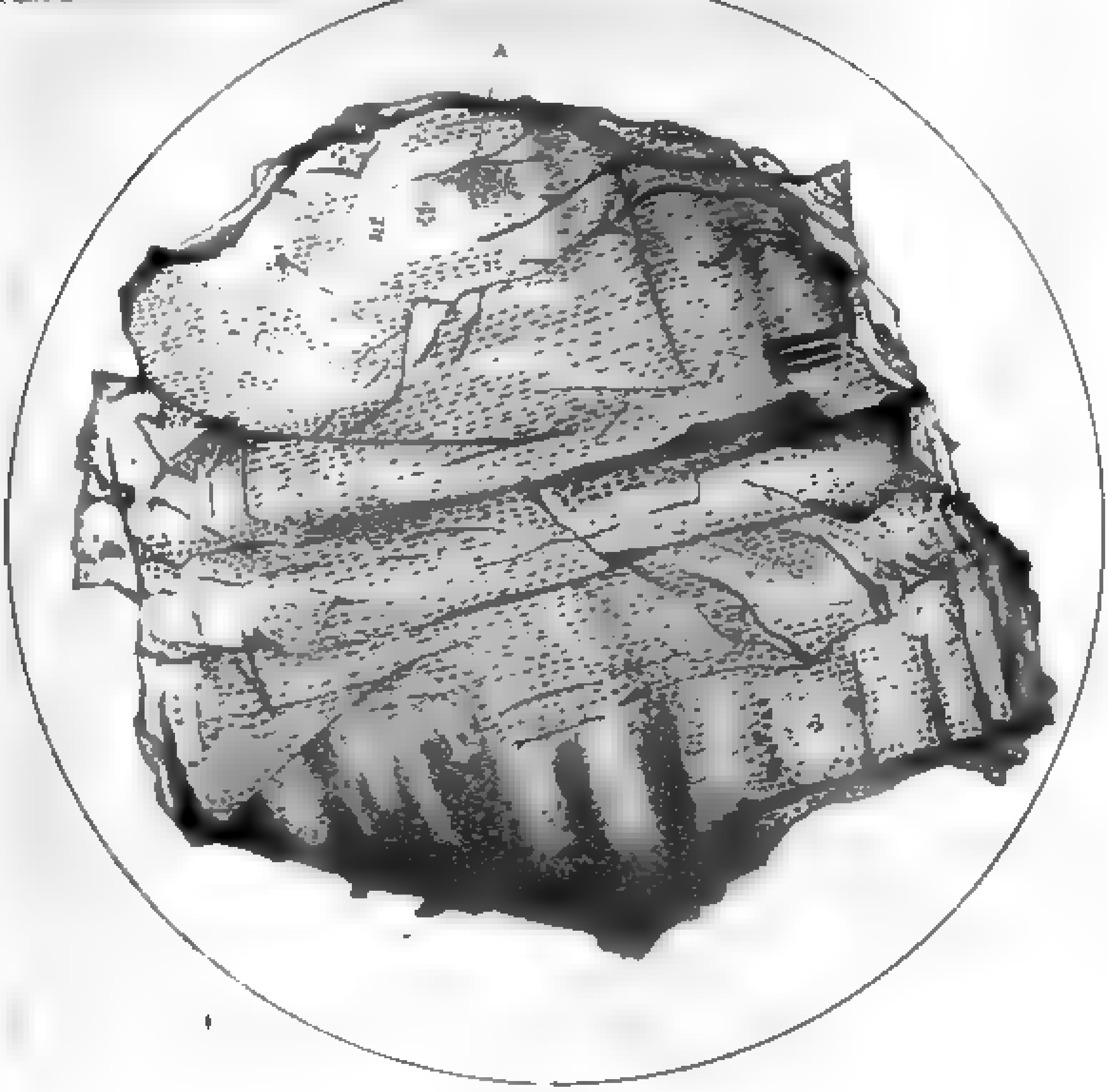

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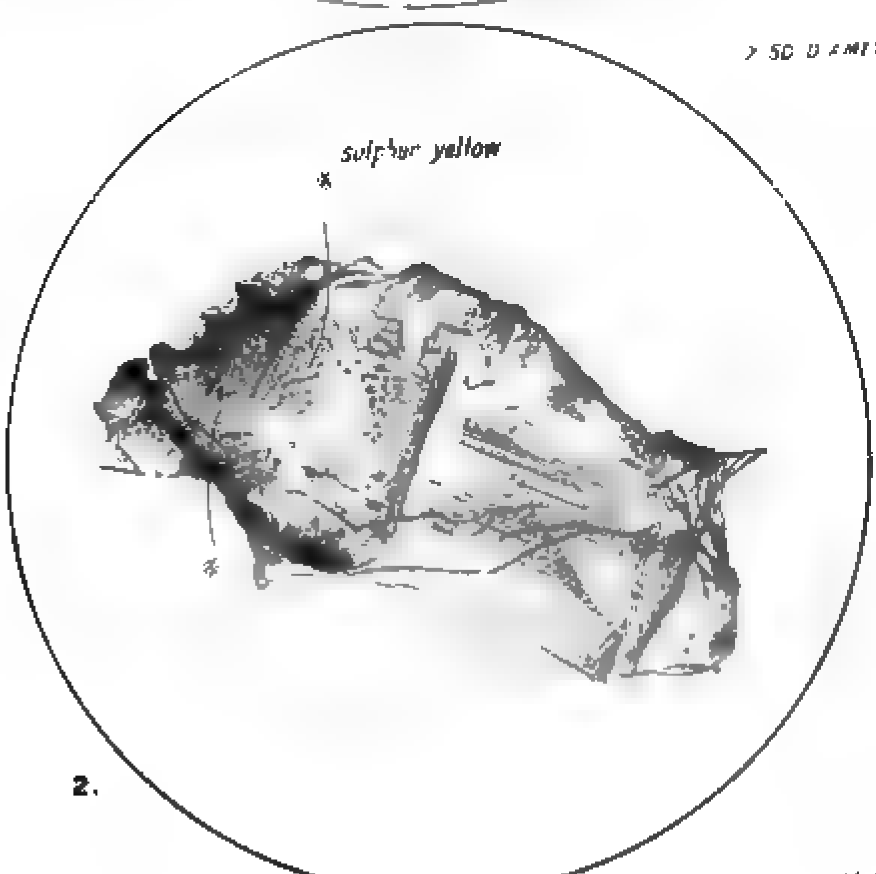

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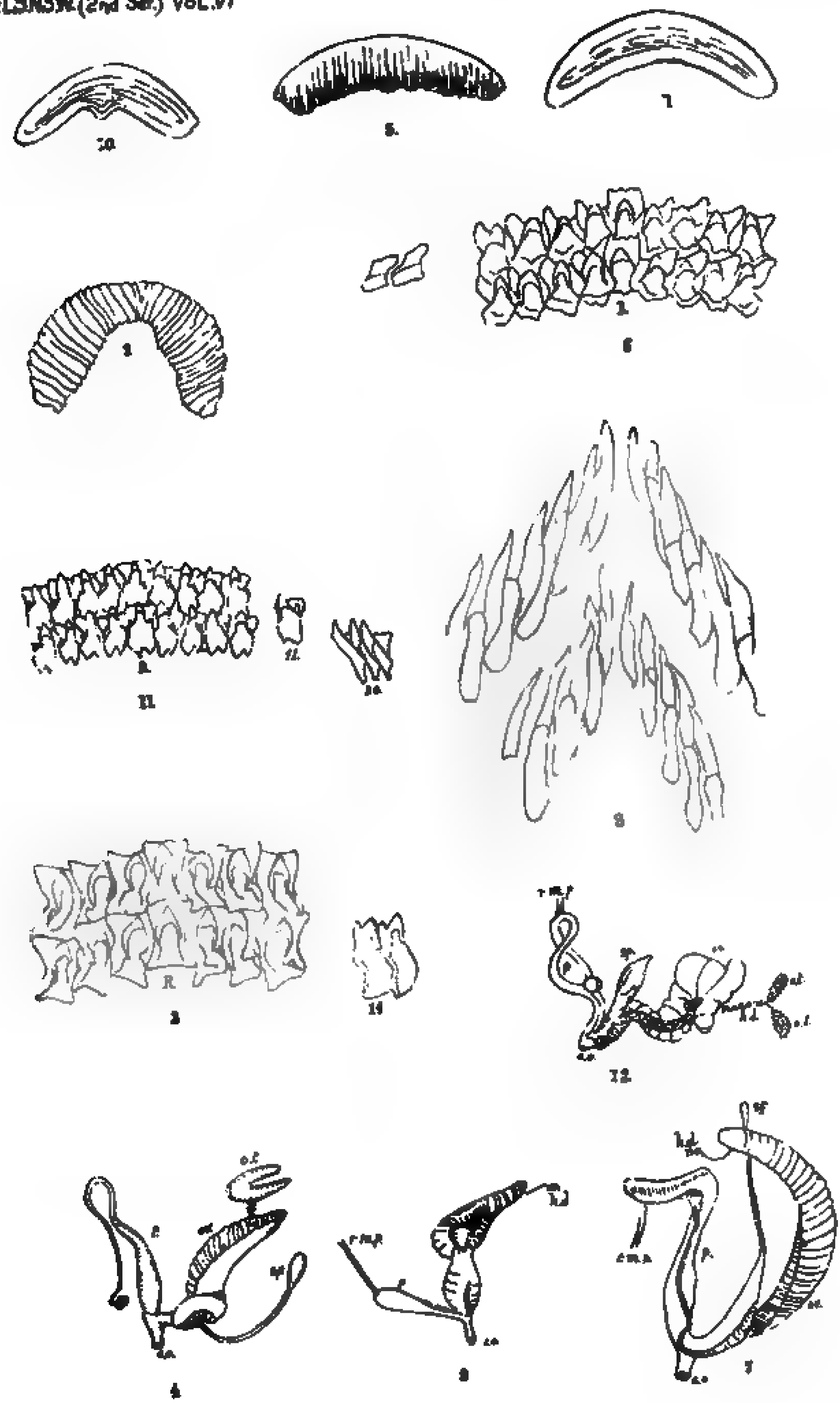

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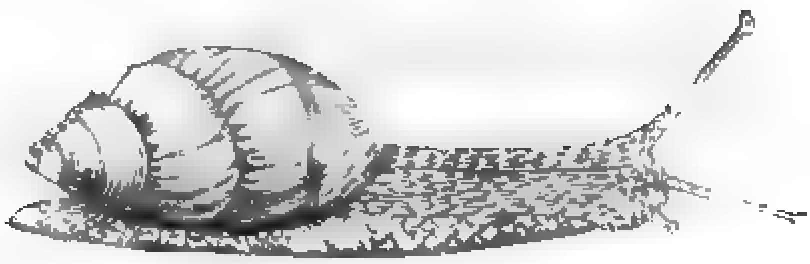

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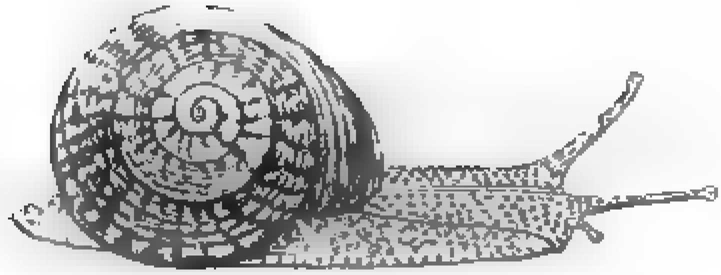

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C. Hedley del ad nat

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P.L.S.N.S.W. 2nd Ser. Vol. V

Pl. V

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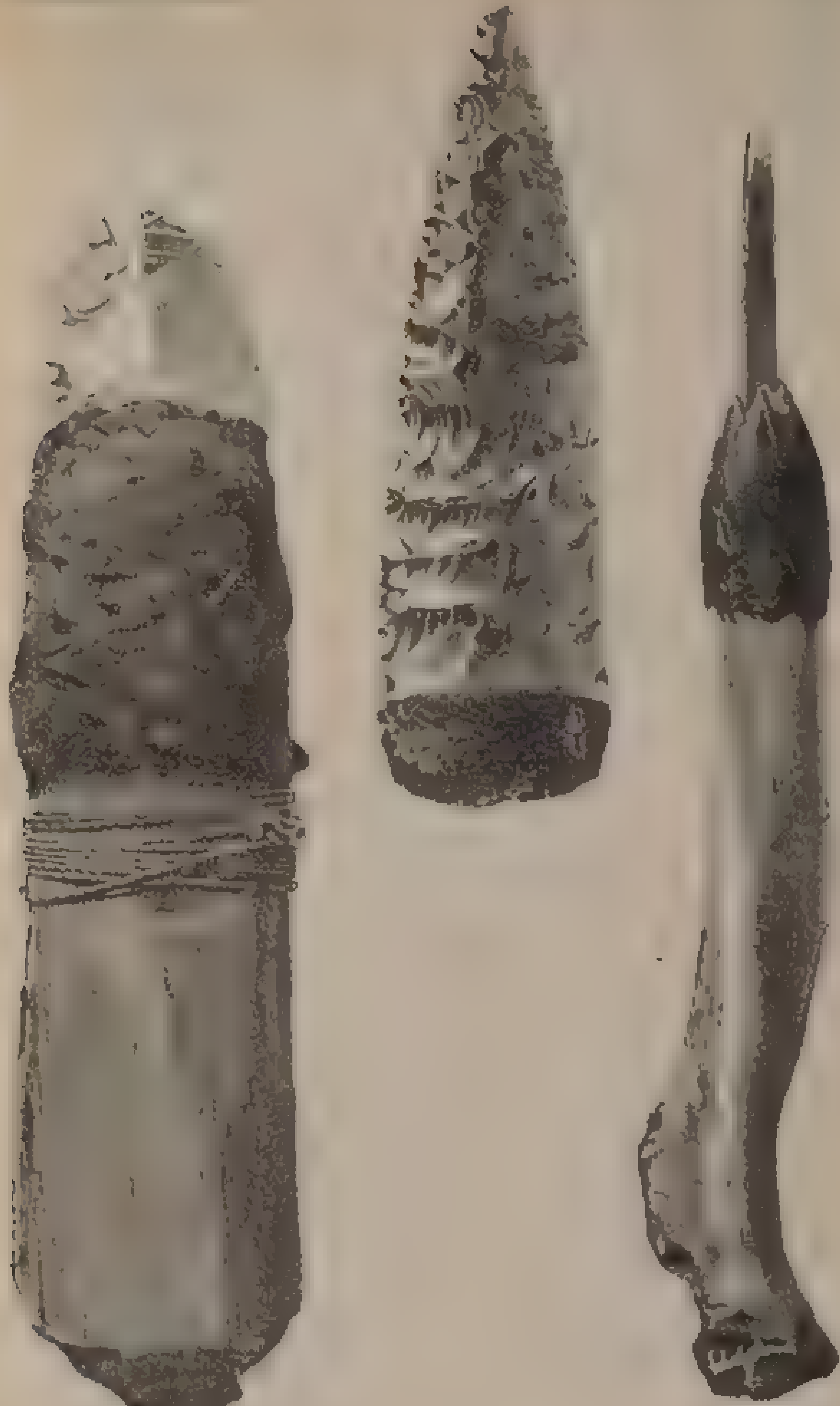

F. A. Baron lith.

P.L.S.N.S.W. (2nd Ser., Vol. VI

Pl. IX.

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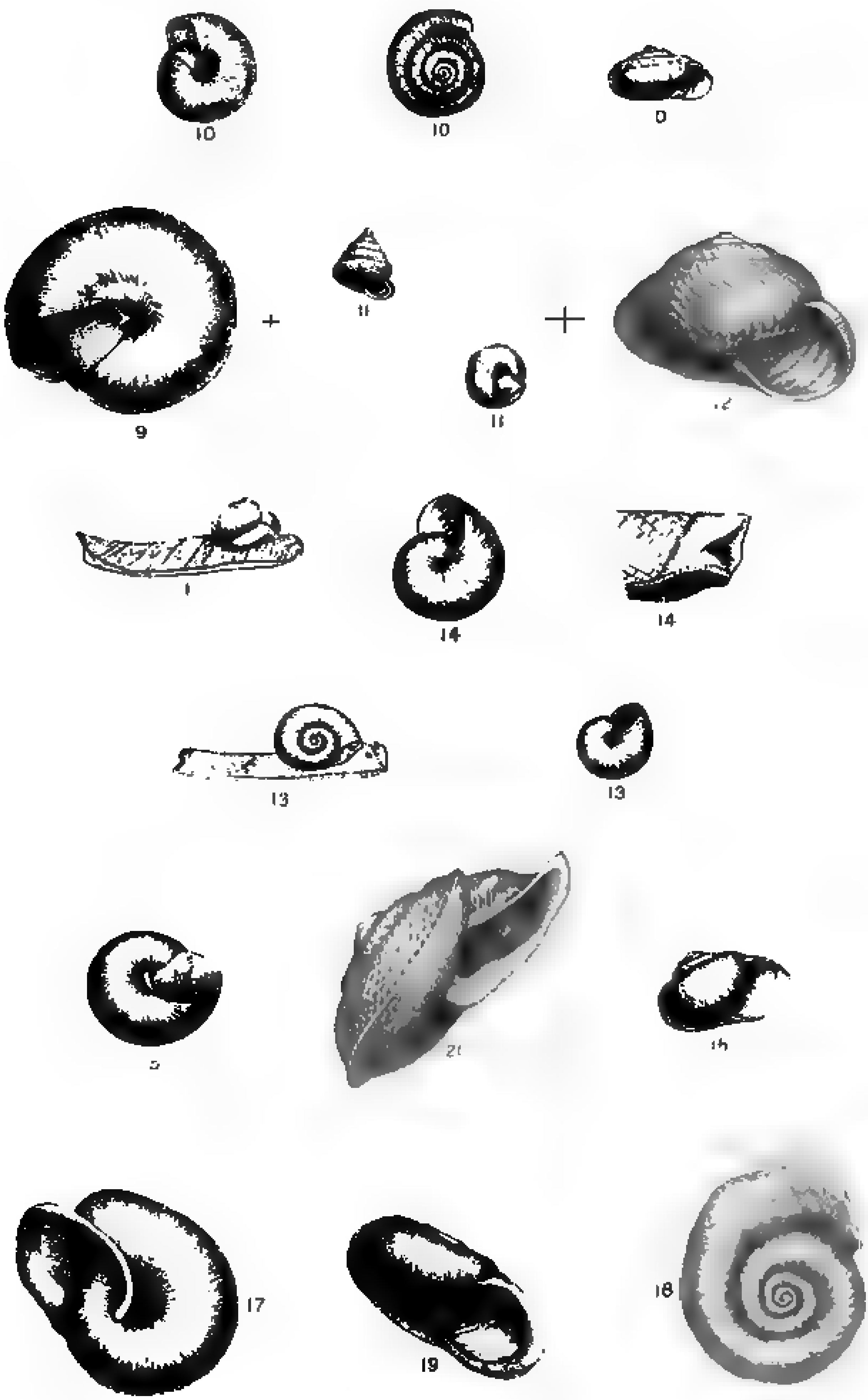

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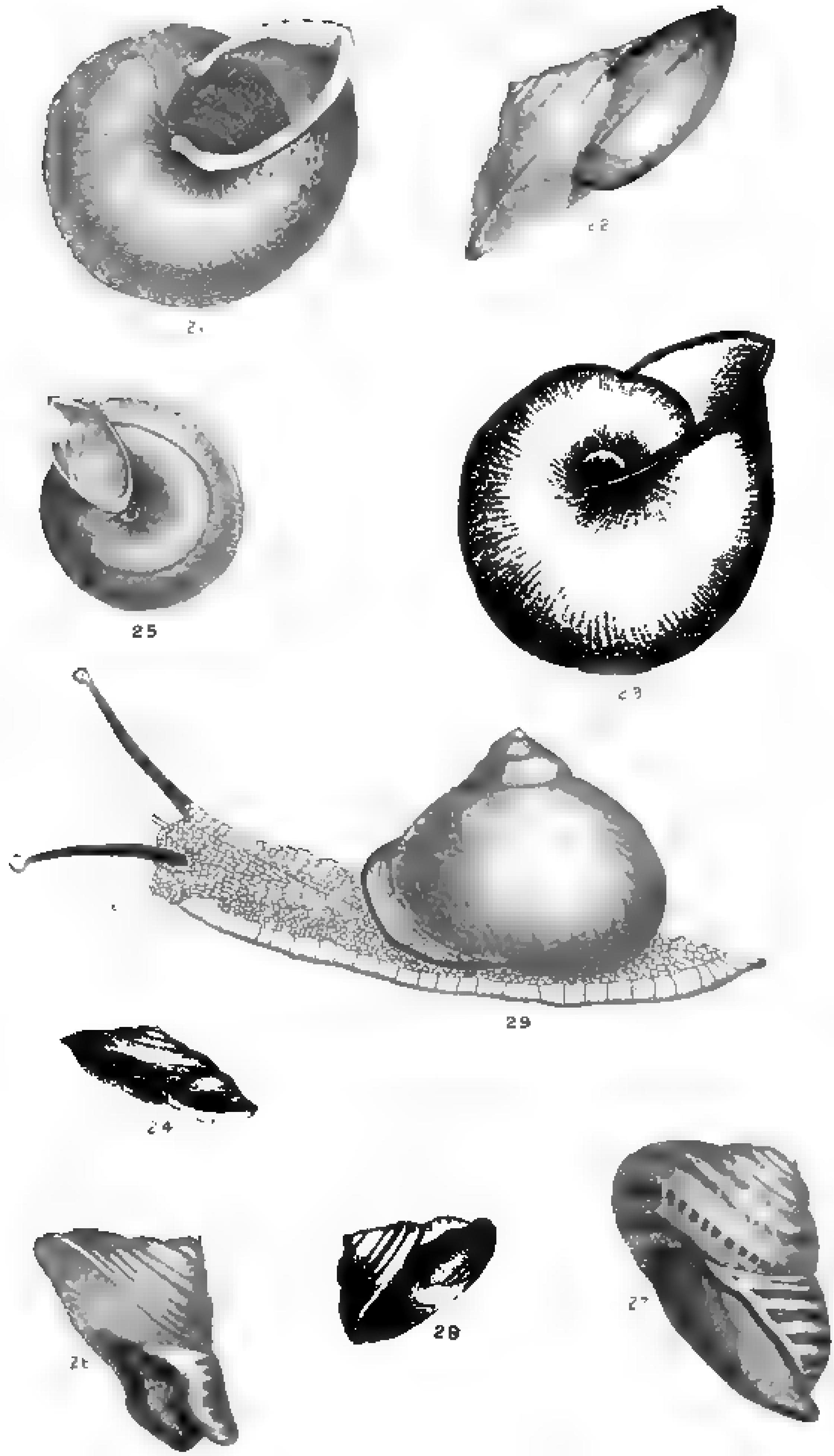

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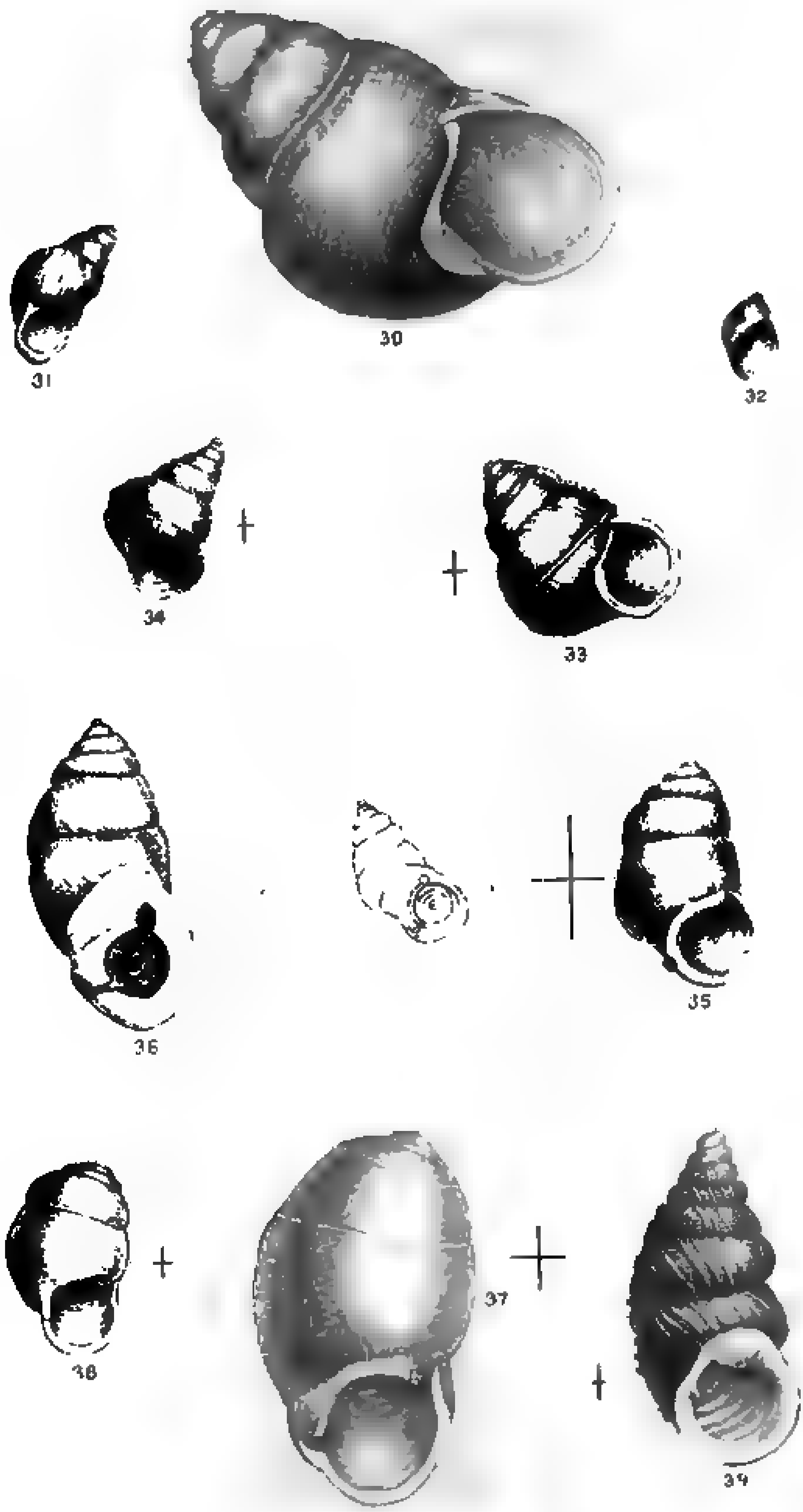

C Hedley del ad nat

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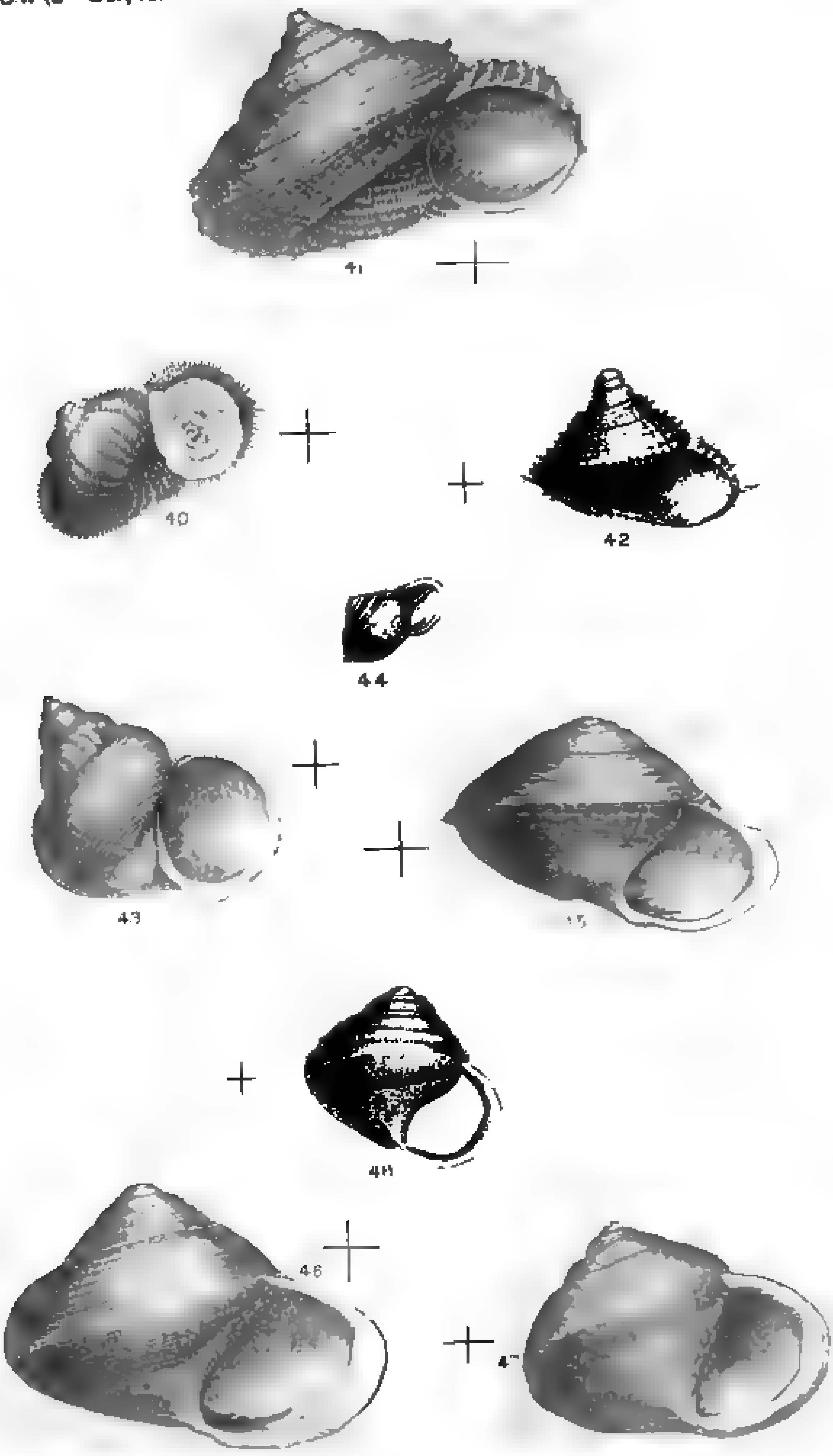
Pl XII bis.



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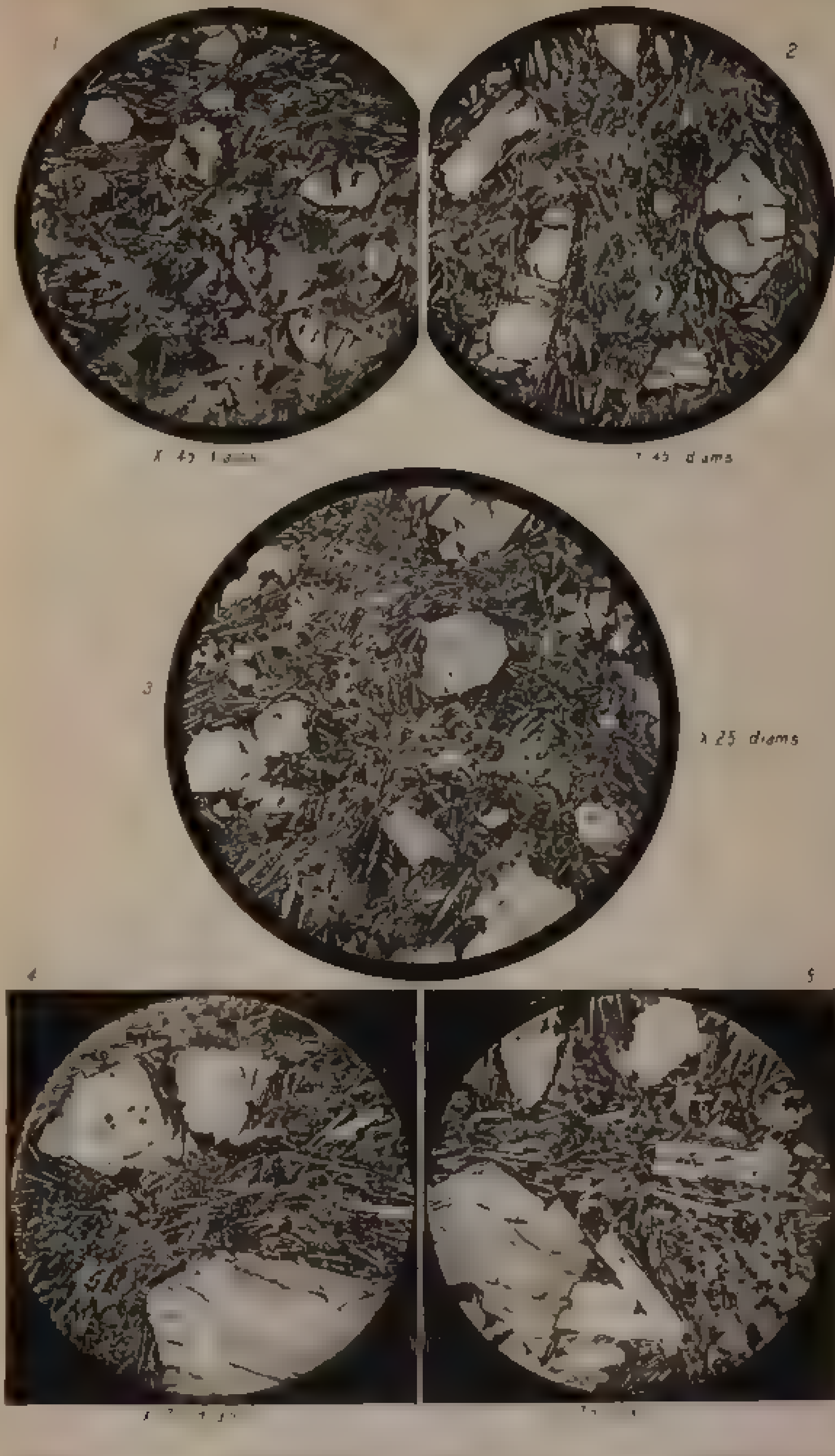
H. A Baron lith

Hedley



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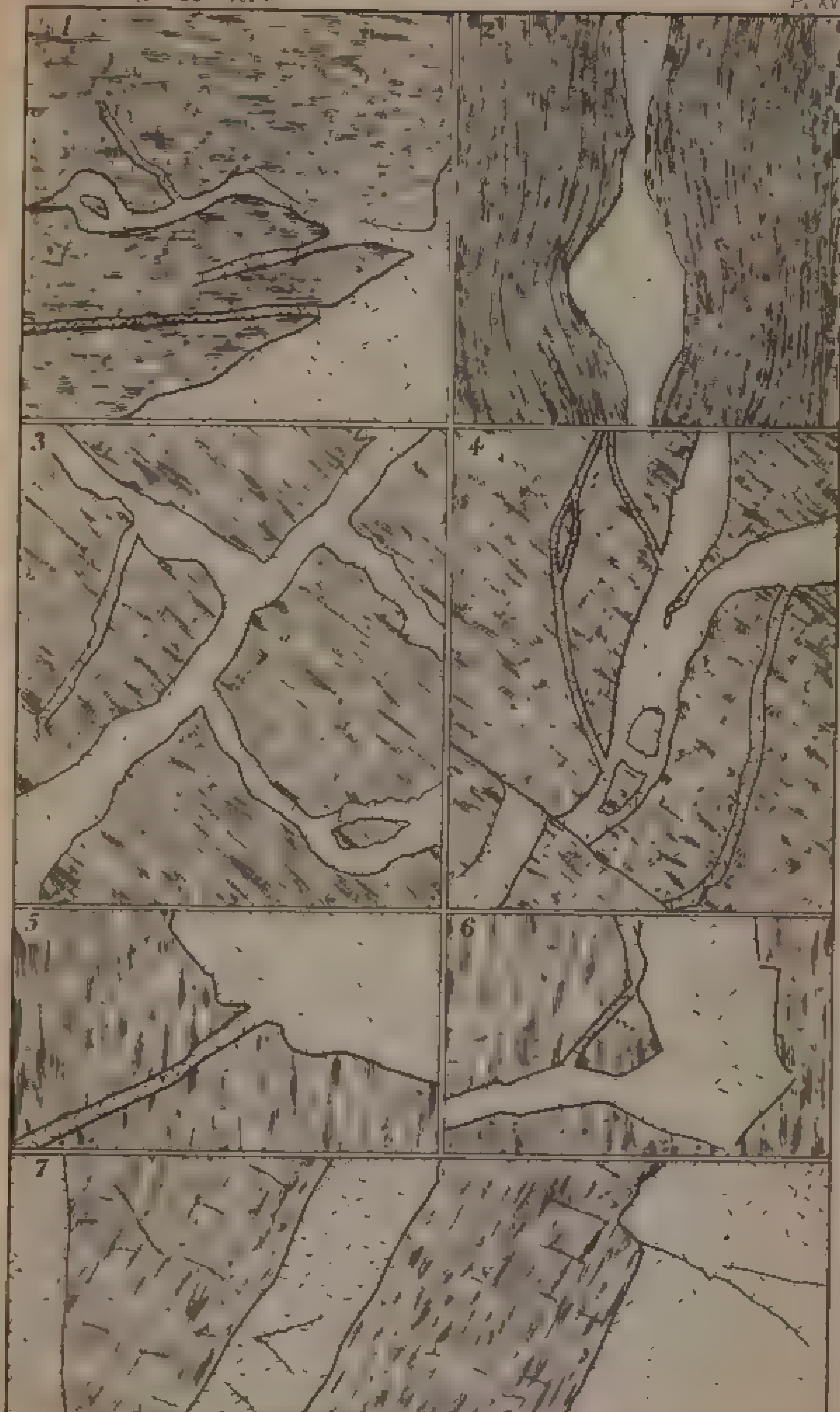
BATHURST BASALTS

Drawn from Microphotographs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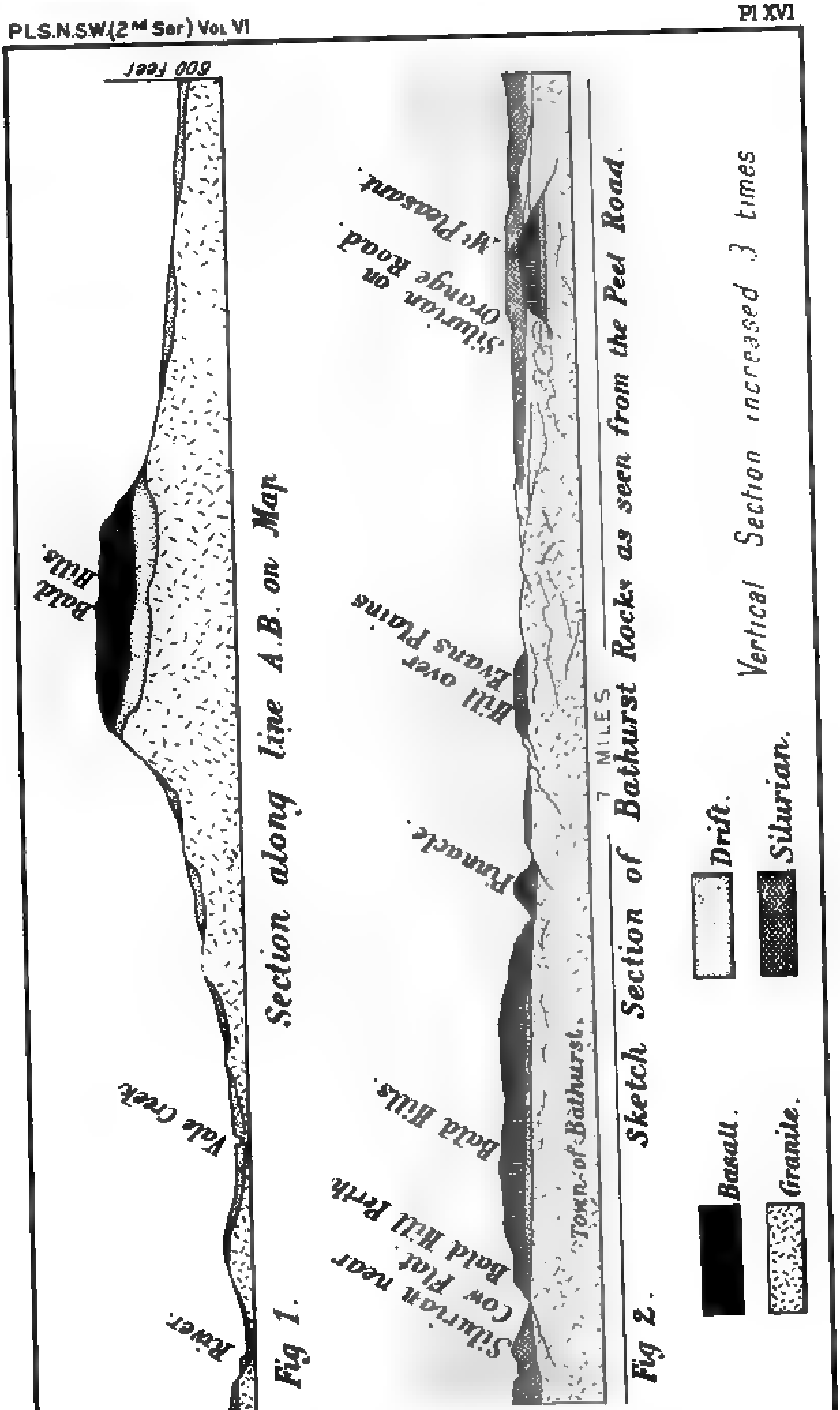

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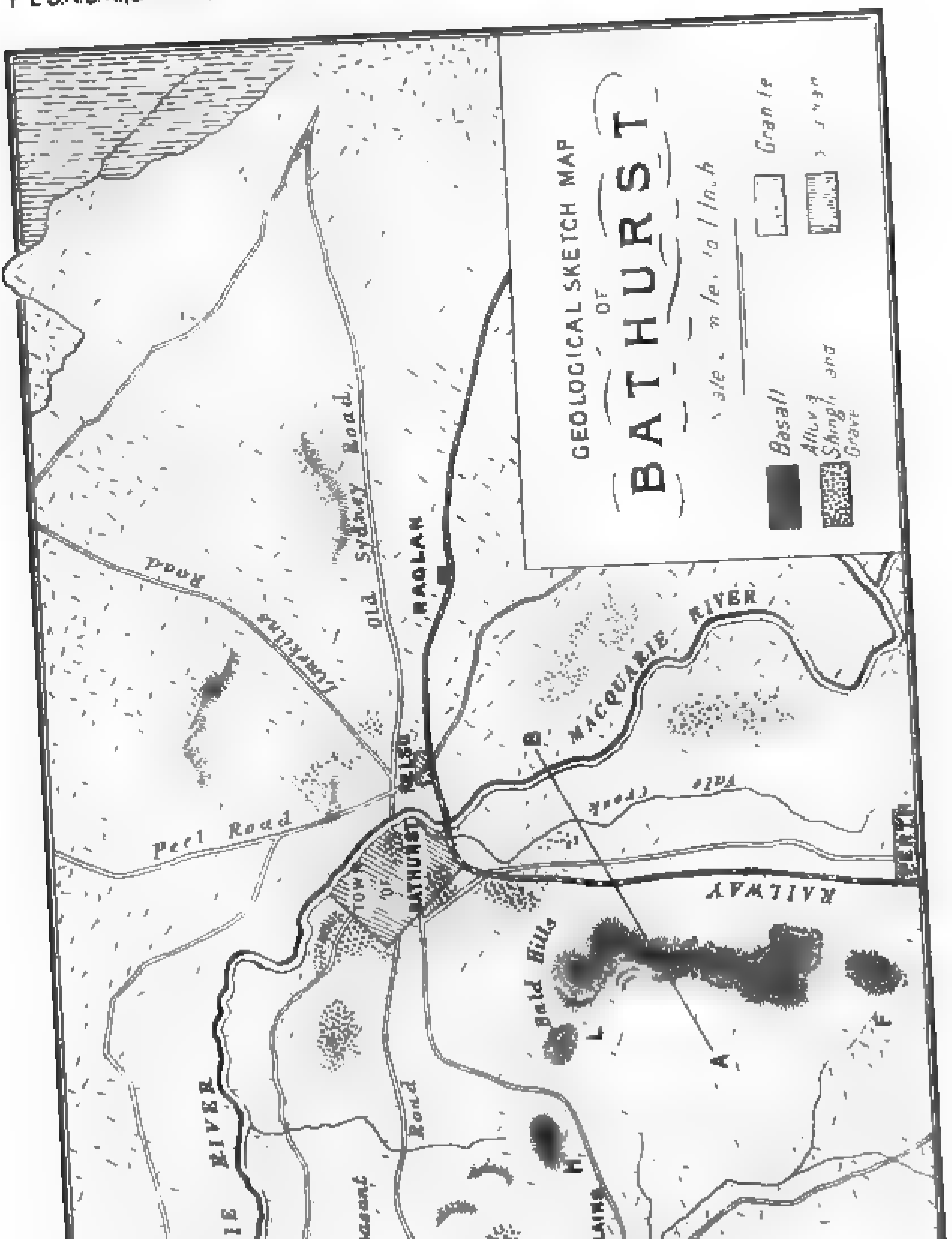
BASALTIC COLUMNS, BALD HILLS, BATHURST.


GEOLOGICAL SKETCH MAP
OF
BATHURST
Basalt
Granite
Old Sydney Road
Limekilns Road
Peel Road
Orange Road
RAGLAN
KELSO
TOWN OF BATHURST
MACQUARIE RIVER
Vale Creek
RAILWAY
Bald Hills
EVANS PLAINS
Mt Pleasant
A
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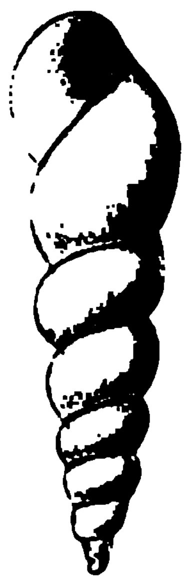
J. H. C. Del
S. T. Leigh & Co. Lith.



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C Hedley Del ad nat

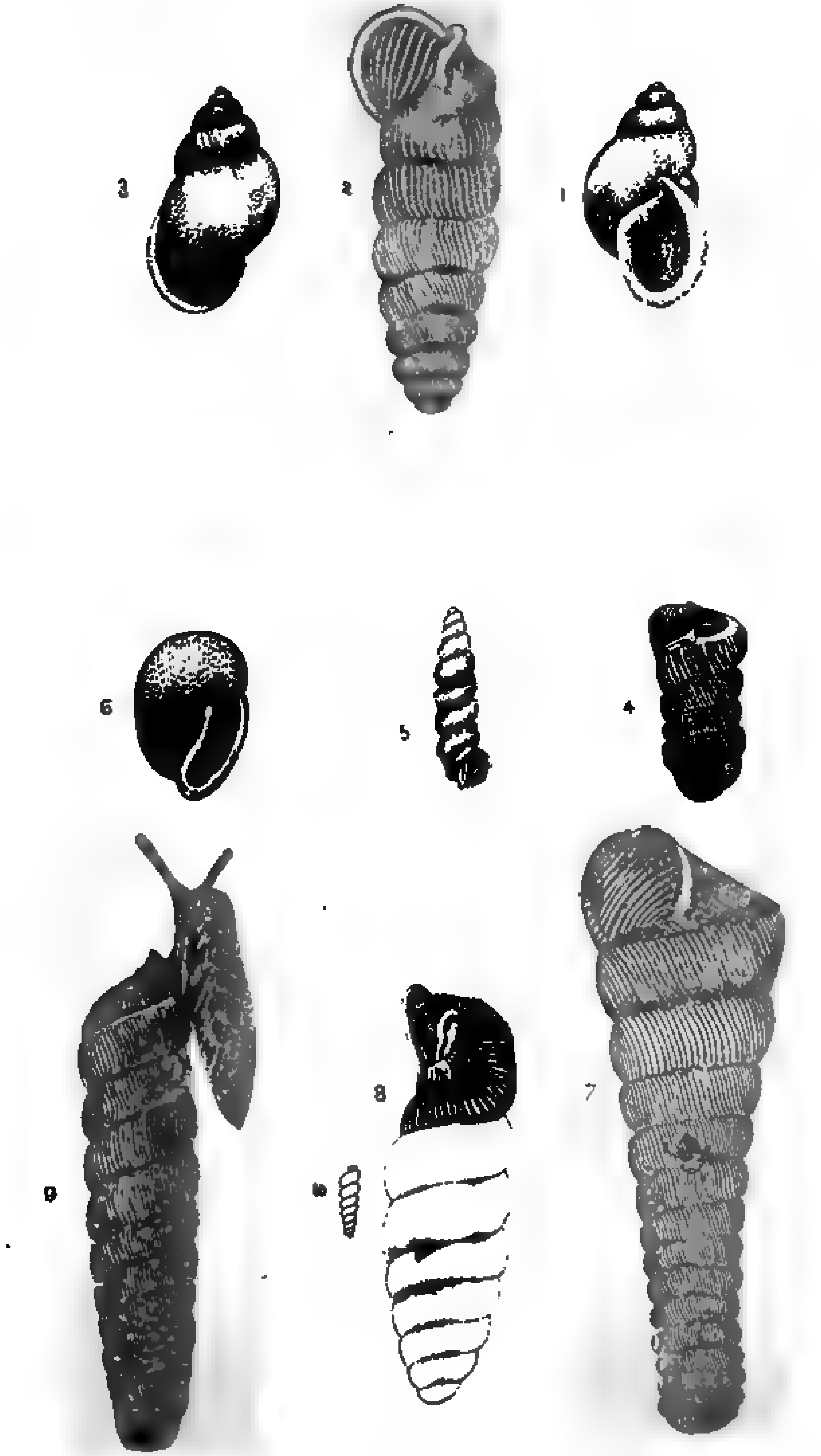
Figs 1-3. EULIMELLA MONILIFORME

Fig 4. CONUS (Chelyconus) WORCESTERI.

S.T.Le

W.C. Del.

BASALTIC COLUMNS, BALD HILLS
BATHURST


3
2
1
6
5
4
9
8
10
7

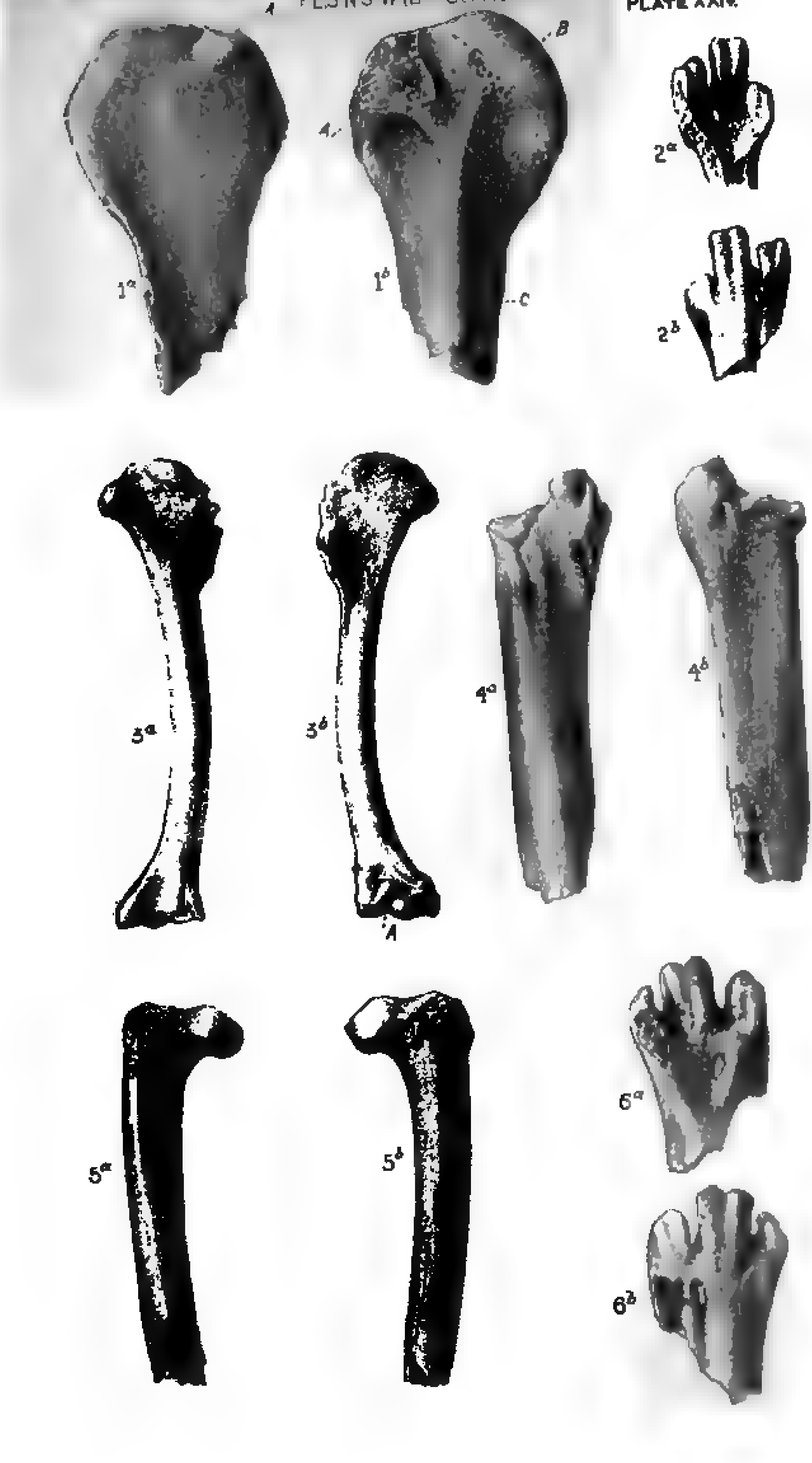
RIGHT UPPER
Adult

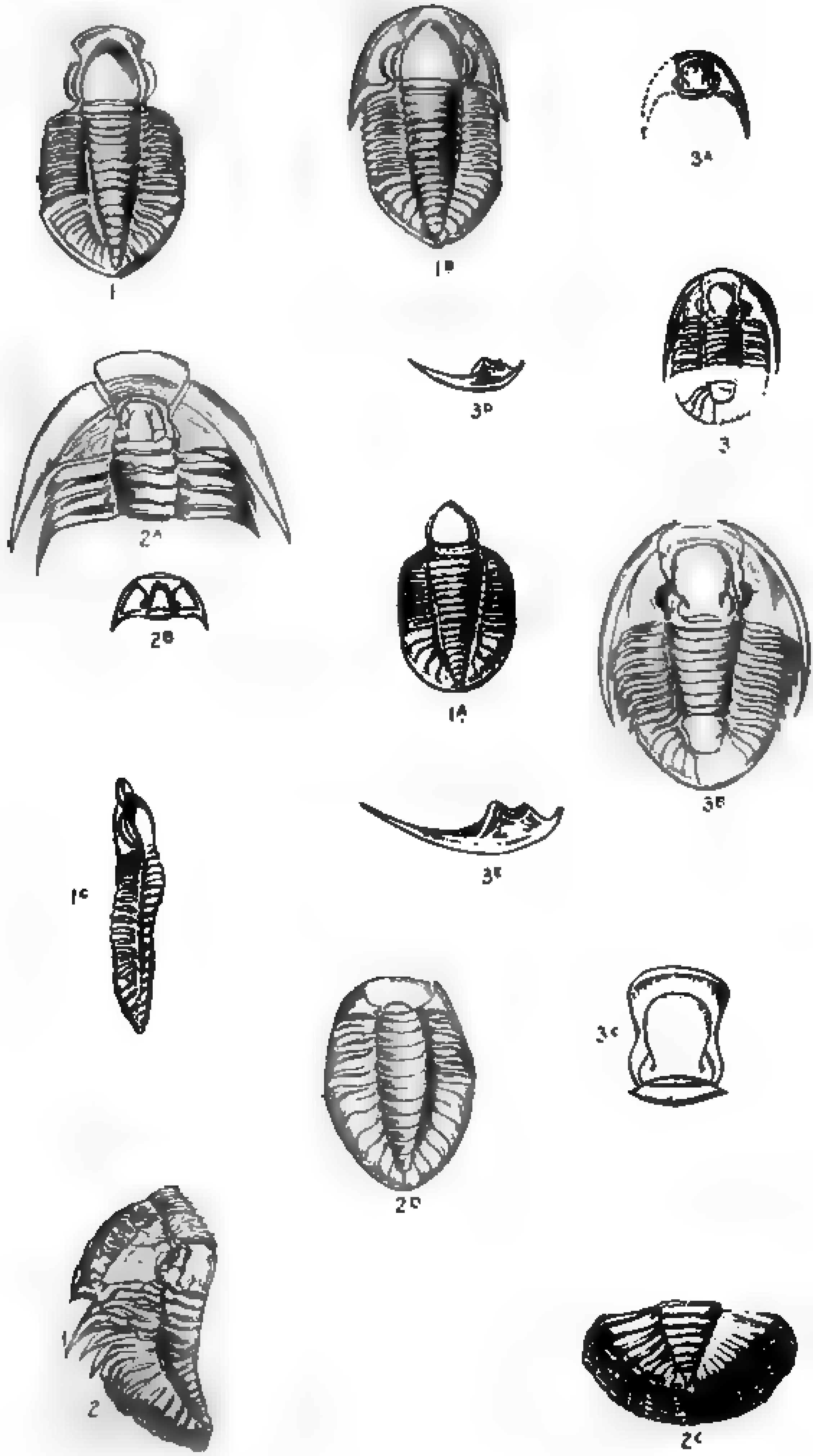
RIGHT LOWER
Young

INCISORS OF SCEPARNODON RAMSAYI


8a
9a
7a
8a
9b

P.L.S.N.S.W. (2nd Ser.) Vol. VI. PLATE XXIV.





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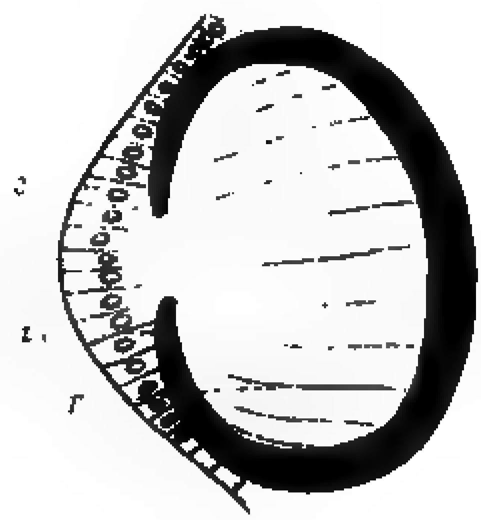
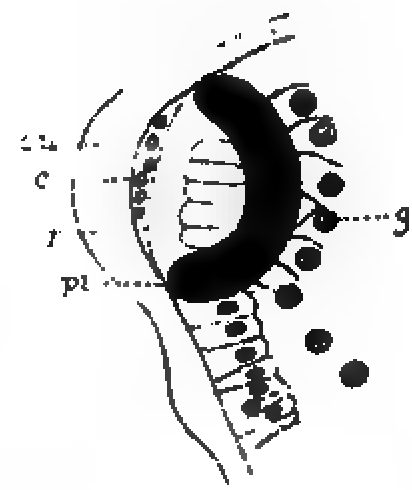
8a
9a
7a
8a
9b
7b

PLATE XXIV

24



27



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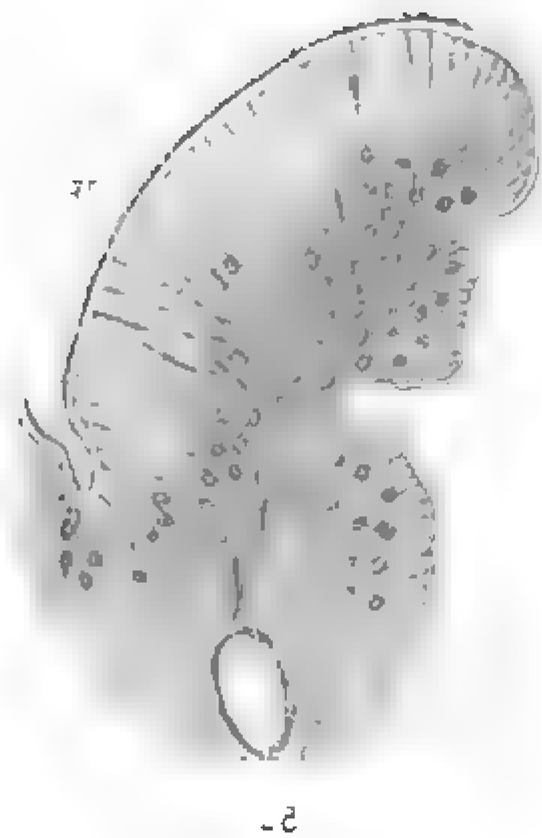

W. A. H. del.

Troedel Cooper & Co. lith. S

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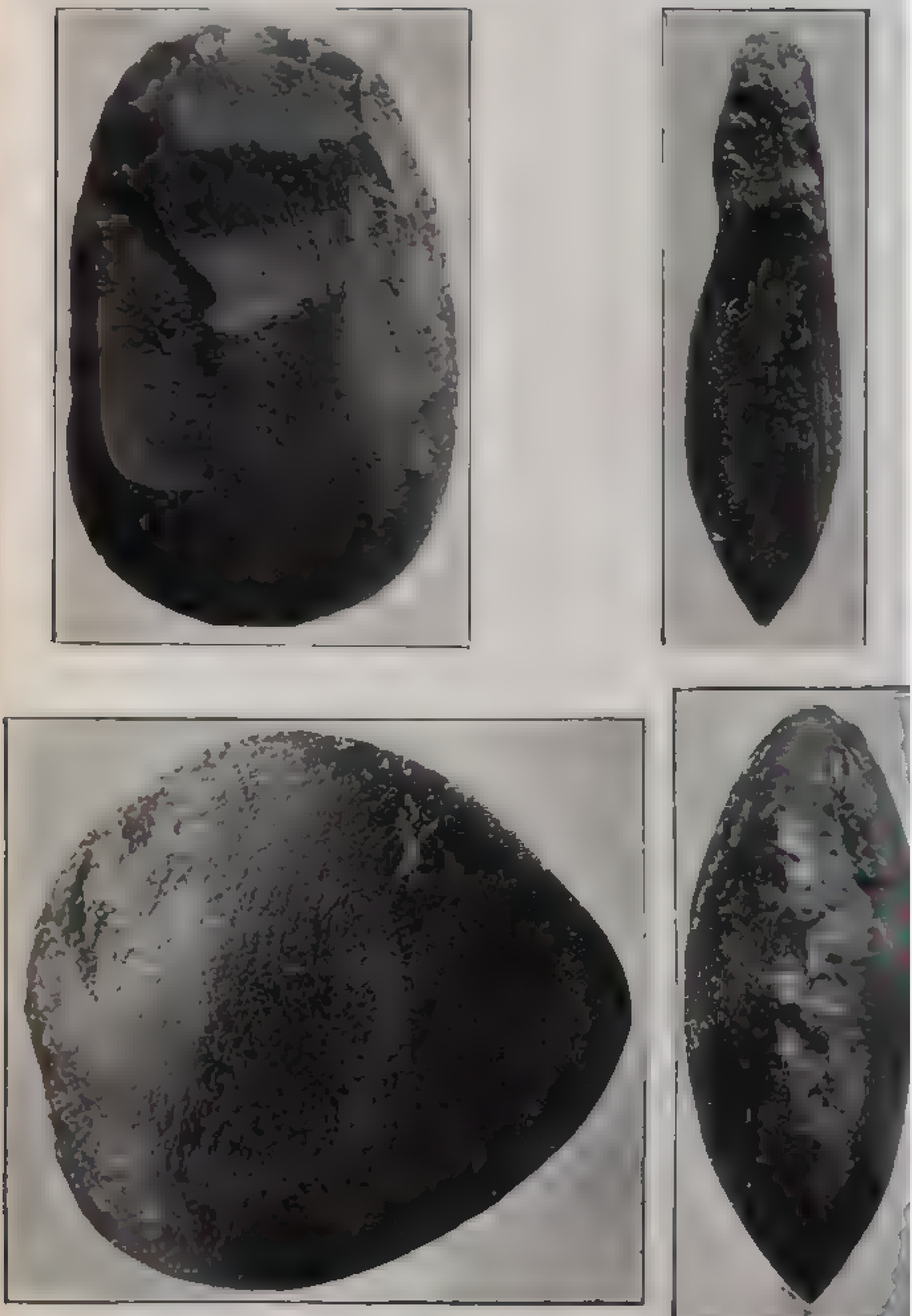
AUSTRALIAN ABORIGINAL IMPLEMENTS.



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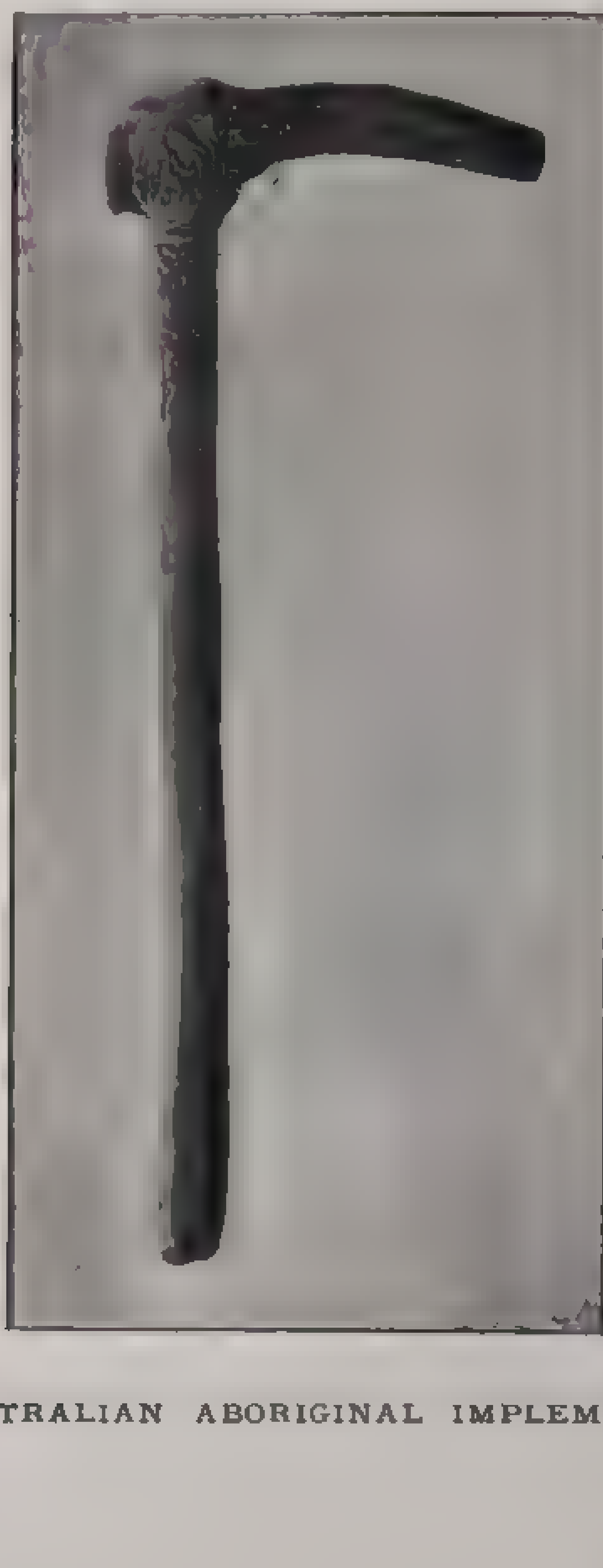

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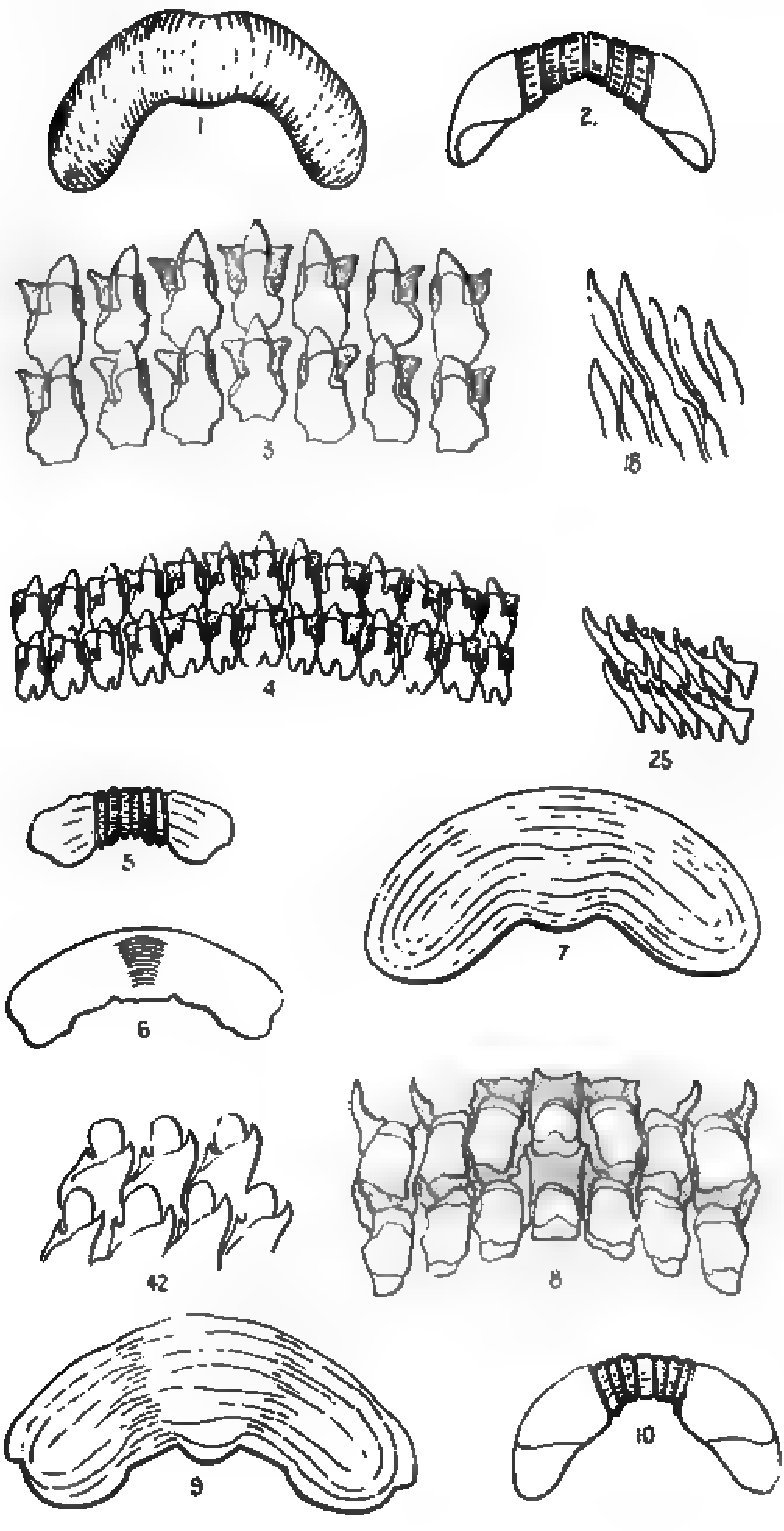

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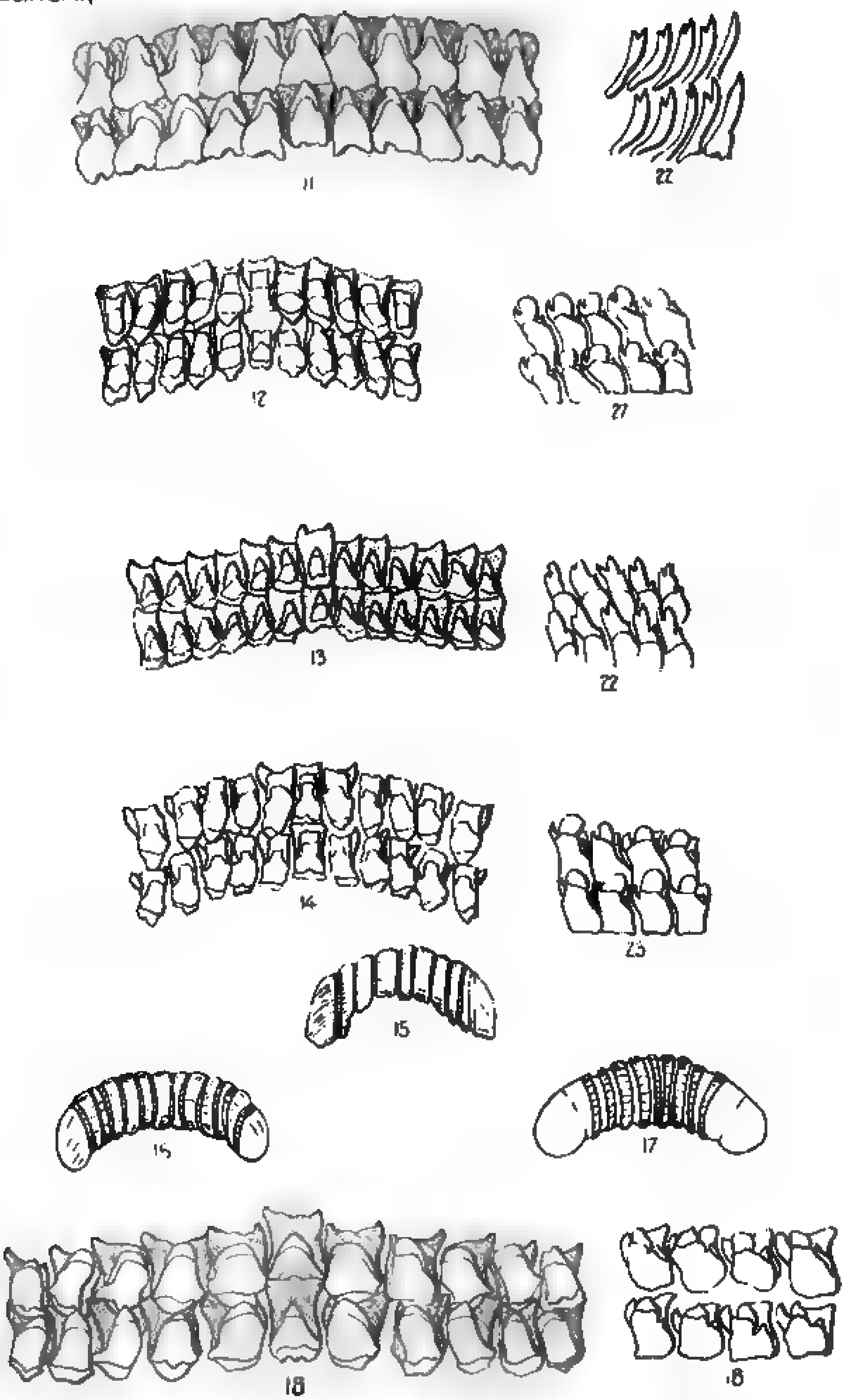
S.T. Leigh & Co. lith.



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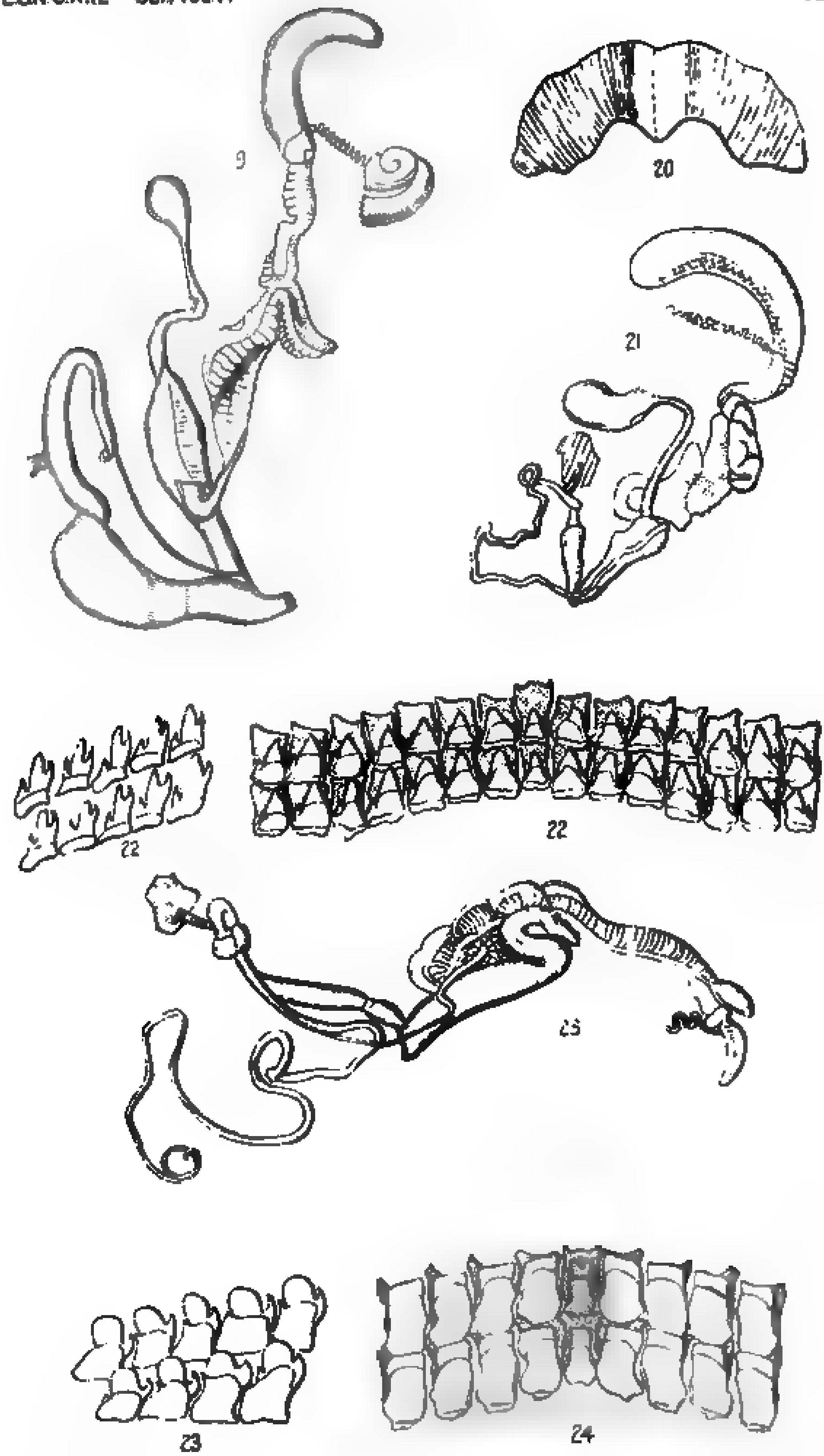

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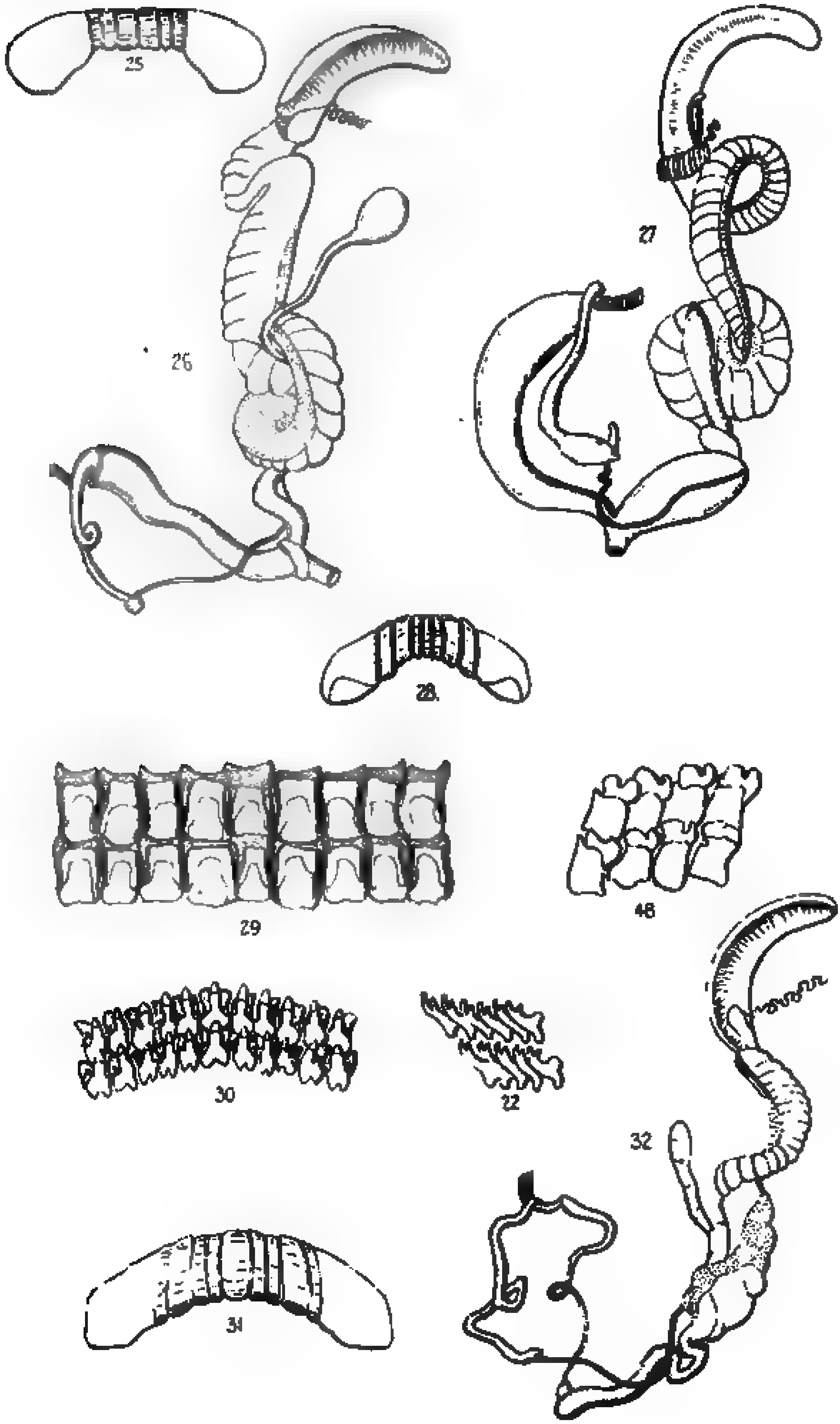

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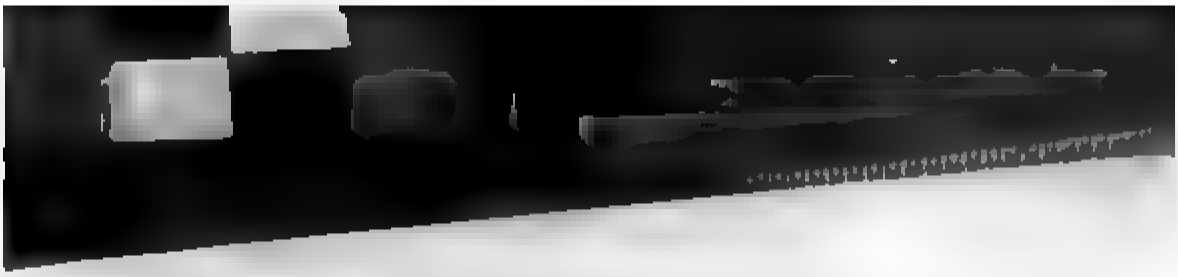

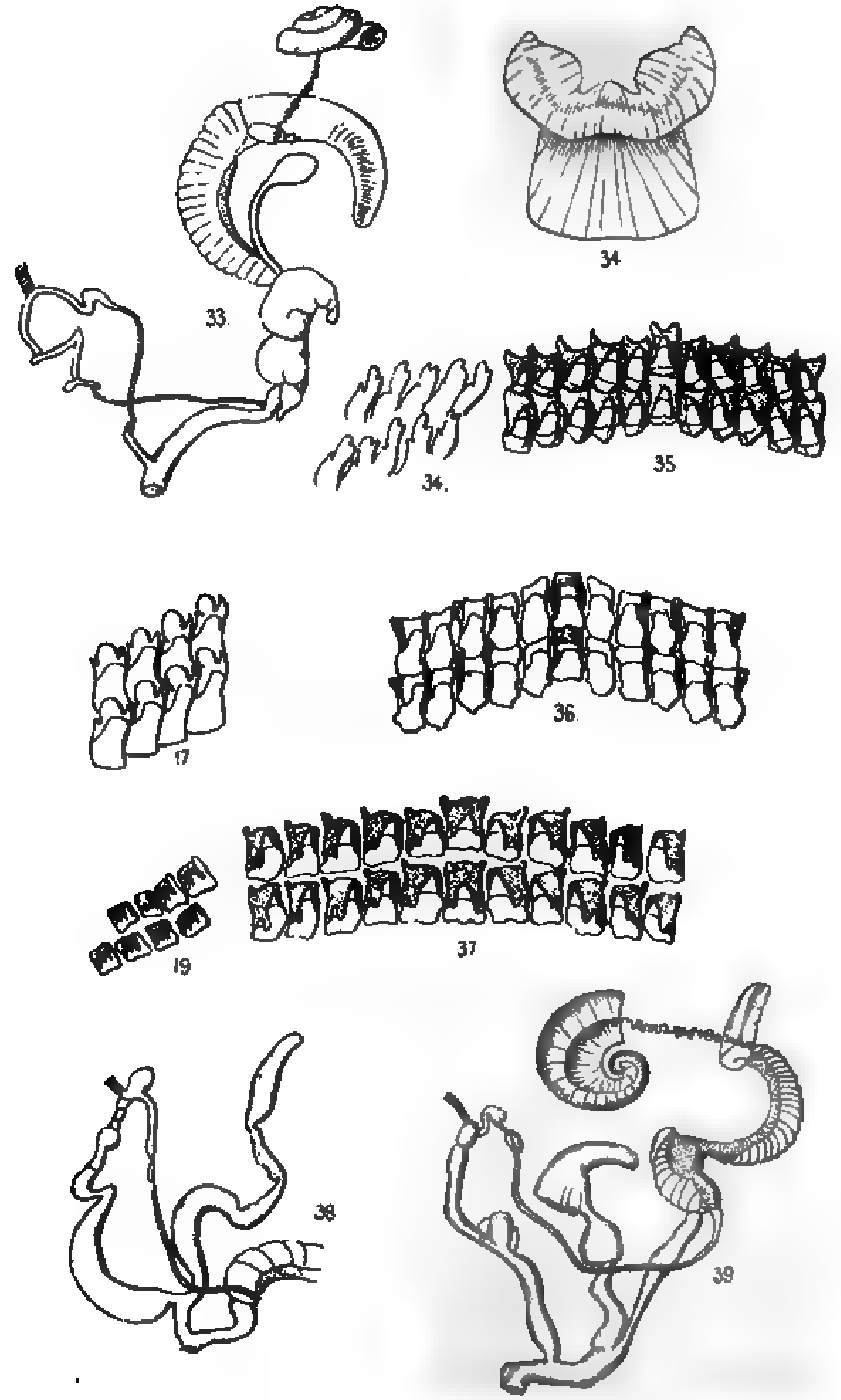

C. Hedley del. ad nat.

S.T. Leigh & Co lith.

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